VOL. LXXXVII. No. 2223. [All Rights Reserved.] JULY 2, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 12s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum. NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageeksy, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

**LITHOLITE INSULATORS, Ltd.**
55—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 692, London
FIREPROOF AND OTHER GRADES
ESTABLISHED NEARLY 20 YEARS

*Birkby's* **"ELO"**
For all purposes for which moulded insulation is required specify "ELO"—which is water, oil and fireproof.
FLEMING, BIRKBY & GOODALL, LTD., LIVERSEDGE, YORKSHIRE.

**WRIGHT** 'Phone: 499 Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham

**BROOK**
ONE, TWO and THREE-PHASE
**MOTORS.**
See Sup. 46.

**SWITCHGEAR**
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON

**MICA & MICANITE**
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
Phone: 575 Central. See Page ii.

**MOTORS. • DYNAMOS.**
VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1245

**CHURTON**
SINGLE and POLYPHASE
**MOTORS**
C. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

**SKATOSKALO BOILER SCALING TOOLS**
Sole Maker:
FRANK GILMAN,
Westfield Road, BIRMINGHAM
See Advertisement this week, page xii.

**"EMPIRE" AUTOMATIC CONTROL**
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW

**WESTERN-ELECTRIC**
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON
TELEPHONES & CABLES
See Advertisement last week, p. vi.

**CONNOLLY'S (BLACKLEY), Ld.**
for
WIRES AND CABLES
See Advertisement this week, p. iii.

**WHITE**
Electrical Instrument Co., Ltd.
*2, 4 & 6, GLOUCESTER ST., CLERKENWELL, LONDON, E.C. 1.*
Wire: Voltigraph, London. 'Phone: City, 8930

**ELECTRIC MOTORS.**
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR Co.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

**INSULATING -- BEADS --**
*Immediate Delivery.*
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

**Two Marks and— a double guarantee.**
See page xi.

*Better than Rubber, Leather and Gutta-Percha.*
**WASHERS.**
**DERMATINE**
DERMATINE CO., Ltd.,
Neate St., London, S.E.5

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
**REPAIRS** TO ANY MAKE **MOTOR STARTERS.**
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL,
Telephone Midland 1213 BIRMINGHAM. Telegrams "Solenoid, Birmingham."

**MAVOR & COULSON, Ltd.,**
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ELECTRIC MOTOR REPAIRS.
**ARMATURES REWOUND.**
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1067. LONDON, S.E. 1

**RAYNER & HEALD, LTD.,**
DUKE STREET, DERBY.
*TWO & THREE-PHASE MOTORS only.*
See page xiii.

**FULLER'S** UNITED ELECTRIC WORKS, LIMITED,
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
Telegrams: Electric, Cent., London. 'Phone: Victoria 6063.

**INGLEBY & CO., LTD.**
ELLAND ROAD, LEEDS.
MOTORS
FOR DIRECT AND ALTERNATING CURRENT
Tel. 378.
Delivery from Stock up to 50 H.P.

*Advertisement Index, see page xl.*

**ENGLISH EDISWAN EVERYTHING ELECTRICAL**

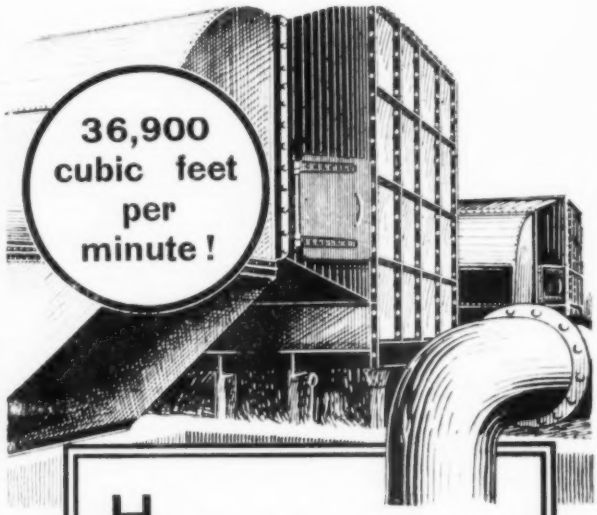
**The house of Ediswan is the best equipped to deal with all enquiries for**

**Everything Electrical.**

**ENTIRELY BRITISH.**

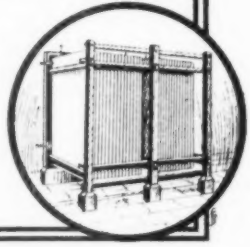
**The Edison Swan Electric Co., Ltd.**
PONDERS END, MIDDLESEX.
London and Provincial Depots.

**36,900 cubic feet per minute!**



HERE are pictured two "Premier" Wet Air Filters at Messrs. The Dunlop Rubber Co.'s Works at Birmingham. Together they have a capaoity of 36,900 cubic feet per minute!

If YOU are in the market for Wet or Dry Air Filters—open type of the latter we illustrate beneath—let us hear from you. We will guarantee the results from any Filter we supply.



**THE PREMIER COOLER & ENGINEERING Co., Ltd.**
Station Works, Shalford,
Nr. Guildford, Surrey.
'Grams: "Precooler, Shalford"
'Phone: Shalford 27.

# MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE 4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

**TAYLOR & PETTERS, LTD.,**
**40, HATTON GARDEN, LONDON, E.C. 1**
*(The Oldest Established Mica House in the country.)*
**AND ALL BRITISH.**

# HADDEN'S ELECTRIC LIGHT & GAS FITTINGS AND ART METAL WORK.

THE designing of Electric Light and Gas Fittings has become a fine art, to attain real distinction in which requires not only authoritative knowledge but good taste and wide experience.

We have a staff of master specialists and highly-skilled artist-craftsmen who possess unique facilities for carrying out work of this character. Original and various Period Designs are a speciality, and a large variety of stock models invite inspection.

● *Enquiries or a visit to our Showrooms places you under no obligation.* ●

**J. HADDEN & CO., LTD.,**
*Electric Light & Gas Fittings Manufacturers, and Art Metal Workers,*
**62, St. Katherine's Road, Notting Hill, LONDON, W. 11.**
Telephone: Park 5024. Telegrams: "Ablivsonet, Phone, London.

Telephone: CITY 3115. Telegrams: "VANDUARA, CENT. LONDON.
Contractors to H.M. Government.

ELECTRICAL INSULATING **TAPES, WEBS, CORDS, SLEEVING, &c.**

DELIVERY FROM STOCK.

**JOHN MACLENNAN & CO.,**
113, NEWGATE STREET, LONDON, E.C. 1, AND AT 188, INGRAM STREET, GLASGOW.

THE

# ELECTRICAL REVIEW.

VOL. LXXXVII. JULY 2, 1920. No. 2,223.

## ELECTRICAL REVIEW.

Vol. LXXXVII.] CONTENTS: July 2, 1920. [No. 2,223.

| | Page |
|---|---|
| The I.M.E.A. Convention | 1 |
| Merchandise Marks | 2 |
| Unwelcome Propagandas | 2 |
| The University of Grenoble, by T. Rich (*illus.*) | 3 |
| The Incorporated Municipal Electrical Association | 5 |
| The Design of Distributing Networks, by C. A. Gillin (*illus.*) (*concluded*) | 6 |
| National Health Insurance Act, 1920.—New Rates of Contributions and Benefits | 10 |
| Electrically Driven Pumps | 10 |
| Business Notes | 11 |
| Notes | 18 |
| City Notes | 21 |
| Stocks and Shares | 23 |
| Market Quotations | 24 |
| The Design of a Super-Power Station, by H. Goodwin and A. R. Smith (*illus.*) (*concluded*) | 25 |
| Gas *versus* Electricity | 26 |
| The National Physical Laboratory | 27 |
| **Correspondence—** | |
| Current Density in Wires at High Temperatures | 28 |
| Power Development in U.S.A. | 28 |
| Direct Current Compared with Three-phase Current for Driving Steel Works Plant | 28 |
| Non-Union Labour and Supply Undertakings | 29 |
| Cable Fault Localisation (*illus.*) | 29 |
| Legal | 30 |
| Reviews | 31 |
| New Patents Applied for, 1920 | 32 |
| Abstracts of Published Specifications | 32 |
| Contractors' Column | Advertisement page xxviii |

**"ELECTRICAL REVIEW" SUBSCRIPTION RATES.**

***UNITED KINGDOM and CANADA £1 12 6 per annum.***
***COLONIAL and FOREIGN .. .. 2 1 6 do.***
**Postage Free.**

## THE ELECTRICAL REVIEW.

**Published every FRIDAY, Price 6d.**

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

***OFFICE: 4, LUDGATE HILL, LONDON, E.C. 4.***

Telegraphic Address: AGERRAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

**FOREIGN AGENTS:**

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

## THE I.M.E.A. CONVENTION.

ON Friday last the Convention, one of the most successful ever held, came to an end, and the members dispersed to all points of the compass; many of them, however, would meet again at the I.E.E. Conversazione last night, and again, perhaps, at the summer meeting of the I.E.E. at Cardiff shortly. The benefit derived from such meetings and reunions cannot easily be over-rated; apart from the papers and discussions, the opportunities afforded for private conversations and the exchange of views are fruitful sources of new ideas and the solutions of knotty problems, and Sir John Snell laid great emphasis on the value to the public of these conventions, in his speech at the annual dinner.

There is, however, one aspect of the matter with which we were somewhat impressed. The speakers in the discussions are almost invariably well-known men, prominent in the electricity supply industry, and it is rarely that one of the "smaller" men takes part; in fact, the same conditions obtain as are observed at the meetings of the Institution of Electrical Engineers. An admirable and successful attempt to induce the juniors to practise the art of debate was made when the "informal meetings" of the Institution were inaugurated; whether the same course could be followed at the Convention is somewhat doubtful, owing to the limited time available, but that the fact constitutes a defect in the existing system seems manifest.

Another point, very similar to the former, is that although the members are all units in the same fraternity, there seems to the onlooker to be little intermingling of the various strata, outside the meeting-rooms. Messrs. 50,000 KW., 20,000 KW., and 10,000 KW. are frequently seen in close communion, and so are Messrs. 1,000 KW., 500 KW., and 100 KW.—but does Mr. 50,000 KW. ever voluntarily associate with Mr. 500 KW.? or dare Mr. 100 KW. button-hole Mr. 10,000 KW.? If so, the incident has escaped our notice, and so far as our observations go, there is little intercourse between the representatives of widely-separated layers in the engineering social structure. We should hesitate to describe the gathering as split up into cliques; the engineer, when you put him to the test, is remarkably free from snobbery or "side," and is usually a thoroughly good fellow, warm-hearted, sympathetic, and unselfish—in a word, a gentleman in the true sense, but modest and retiring to the last degree. That, we believe, is the root of the trouble to which we have referred. The older men fear to appear patronising, the younger ones fear to be thought presumptuous, and so they seldom meet on the level of common membership and equal rights. We venture to draw attention to this flaw in the otherwise admirable proceedings at the Convention, with a view to its removal on future occasions. What is wanted is the spirit of comradeship on all sides, the complete absence of "stand-offishness," or rather, perhaps, shyness.

The papers and discussions at this Convention reached a very high level of interest and usefulness, although they afforded little opportunity for the "committee members" to take part. Mr. Gillin's paper gave a comprehensive survey of the distribution system, and fully merited the award of the Association Premium. Mr. Robinson's paper summarised the results of a questionnaire addressed to the members of the B.E.A.M.A., and the author, therefore, was

unable to give free play to his own views; we note, however, that in his introductory remarks at the Wednesday meeting he drew attention to the article on "The Design of a Super-Power Station," part of which we reproduced in our issue of June 18th, and pointed out that many of the conclusions put forward by the authors agreed with those given at the end of his paper. We have now, therefore, a statement which may be taken to represent fairly accurately the considered opinions of both British and American engineers on present-day practice in connection with the design of large power stations—but many new ideas are in the air, as will be seen when we publish a report of the discussion on this paper, and we both hope and expect to see material changes in the near future. It is significant that nothing is said with regard to gas-firing, recovery of by-products, &c. Apparently effort is at present concentrated upon the improvement of the power station as we know it, and radical departures from current practice are not at present contemplated. A thermal efficiency of 25 per cent. was foreshadowed in the discussion. We shall return to this subject at an early date.

The paper by Mr. Beauchamp of the E.D.A., on "The Standardisation of Tariffs," completed this symposium on the electricity supply industry, which does credit to the Council of the Association; the three papers, emanating respectively from three Associations, with the discussions will form a valuable source of information and instruction for all engaged in the industry. Mr. Beauchamp's paper called forth a lively discussion, revealing widely divergent views, but on the whole the sense of the meeting was with the author; a plain flat rate does not meet the needs of the case, and some form of fixed charge together with a running charge is generally regarded as the most appropriate basis for an equitable and remunerative tariff.

The proceedings at the annual general meeting were no less interesting, but the limits of our space compel us to defer comment upon them to another occasion. We must not, however, let pass the opportunity of offering our congratulations to Mr. Roles, not only on the success of the Convention, which was so largely due to his efforts and the loyal support of his staff, but on the personal success which he scored by his admirable conduct of the meetings and other functions over which he presided.

---

**Merchandise Marks.**

ALTHOUGH in the abstract and on broad national grounds it may seem desirable that all goods coming from foreign countries should bear some indication of their origin, it may surprise some people to know that the case in favour of this course is not absolutely overwhelming. The Merchandise Marks Acts of 1887 and 1891 are familiar documents in the business world, and they have for their main object the protection of trade marks and trade descriptions, but they deal also with the importation of goods and their marking. These particular provisions, however, have not been altogether satisfactory—at any rate, from the point of view of those good patriots who believe that people in this country have only to be told that an article comes from some foreign country to refuse it. We venture to think—heresy though it be—that this is not quite the general attitude, and it is becoming even less so under the lash of high prices of British goods. However that may be, Sir Auckland Geddes, when he was President of the Board of Trade, appointed a Committee, the Chairman of which was Mr. Harry Greer, M.P., to inquire into and report whether any extension or amendment of the Merchandise Marks Act is required in respect of provisions relating to indications of origin, and also with regard to the use of national trade-marks; and, further, how far international action might be brought about for the purpose of preventing the false marking of goods. This Committee has now reported, and the first thing it came up against was the conflict of opinion mentioned above. It may be said that differences arise as between the British manufacturer and the merchant or importer. The former's business has been built up on the slogan, "British made," and undoubtedly it carries enormous weight, probably more so in the foreign market than the home market. To him, therefore, comes the view that anything labelled "Made in Germany," or anywhere else, must impress the prospective buyer with a feeling of its inferiority. Hence he wants all foreign goods labelled to show their origin as conspicuously as possible.

On the other hand, there is the merchant. Superficially, he puts forward the case that to label all foreign goods with the name of the country of origin is to give that country a free advertisement. Actually, the real fact is that the merchant, quite naturally, does not wish always to disclose the source from which he obtains his goods, although it is difficult to imagine how he can avoid doing so, if his customers insist on knowing. On the whole, we agree with the Committee in thinking that in some trades—we hardly see why there need be any limitation—it would be to the general advantage for all goods to be plainly marked with the name of their country of origin. The difficulty experienced by the Committee is evidently considerable, for it is unable to make any direct recommendation, but places the onus on the Board of Trade, after an official inquiry in each case, of dealing with the question by order. The powers proposed to be given to the Board of Trade are wide, and include specifying, not only whether an indication of origin (either specific or general) is to be given, but the form of the indication, the manner in which it is to be given—whether by mark to be placed upon the goods, or in some other manner—and indeed, the whole question in all its aspects will be dealt with. It is not indicated exactly in the report what the machinery should be for setting the Board of Trade in motion, but presumably an application would be made by interested people, and then an official inquiry would be held at which all parties concerned would express their views. It seems a rather laborious process, although perhaps the only way out with a matter of this kind upon which views, as a whole, are too conflicting for comprehensive legislation. As things stand at present, of course, the position is circumscribed by the Merchandise Marks Acts. The question whether goods should be marked to show their country of origin is closely bound up with the use of false or misleading markings, although this latter applies equally to British-made goods. In this respect, the Committee recommends the amendment of Clauses 2, 3 and 5 of the Act to include in the broadest possible manner all indications, descriptions, or statements, oral, documentary or other, whether physically attached to the goods or not, including statements in advertisements and catalogues, and false indications given by trade names or titles of firms or companies, which are reasonably calculated to lead a purchaser to a false belief as to the origin of goods. At present, a false indication, in order to come within the Act, must be one in writing, and physically applied to the goods. A number of other recommendations are made, but on the question of national and other collective trade-marks no amendment of the present law is suggested. In the absence of general agreement, there are grave objections to a British national mark.

---

**Unwelcome Propagandas.**

THE difficulties of the Press are not lessened by the efforts of those who seek to make anonymous use of its "Correspondence" columns as the agents of organised propagandas. Experienced editors are not likely to be misled by the many communications of the kind that have lately been issued from various addresses in the London suburbs. They are too obviously alike, and are the work of the professional publicity man. We decline to lend ourselves in this way to the making of public opinion with regard to mining or any other legislation. Everything is to be gained by free and unfettered discussion of the great questions that confront us in these critical days, but let us have a plain statement of the case from central organisations which are not ashamed to attach their names, or from individuals who are expressing their independent views. Brown may write from Battersea, Smith from Streatham, and Robinson from somewhere else, letters apparently typed on the same machine in the same office, arguing for or against a certain Bill, but so far as we are concerned the destination of these communications will be the same in all cases.

# THE UNIVERSITY OF GRENOBLE.

## Technical and Vacation Courses.

By THEODORE RICH.

For many years it has been usual for numbers of students on the Continent to conclude their education by spending a year or more at some foreign university. In recent years comparatively few British students have gone abroad for student life. The French educational authorities are sufficiently broad-minded to realise that the presence of foreign students at their technical schools will be to the national advantage, and that the interchange of opinions, which the presence of such foreigners naturally encourages, will be of benefit to their young people.

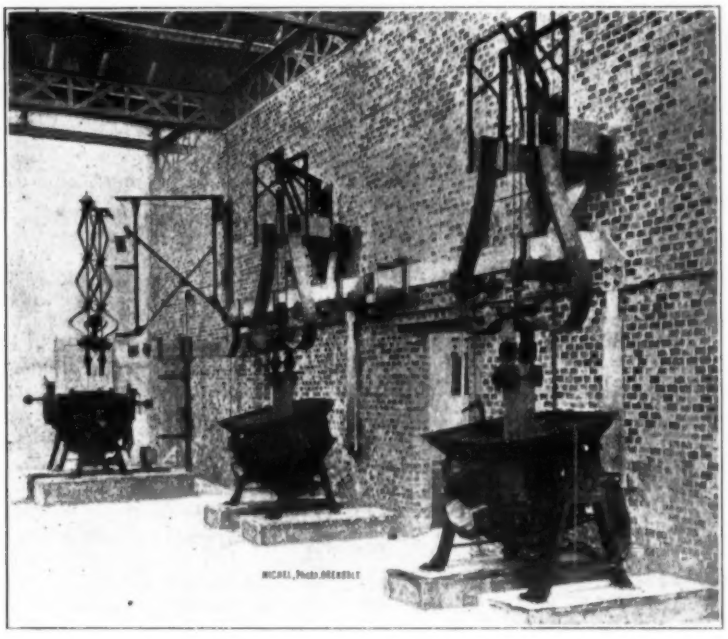


Fig. 1.—Electric Furnaces at Grenoble University, France.

The commercial advantages of the foreign student were so much realised by the Germans before the war, that riots and commotions were actually organised by the German Foreign Office in the Universities of Russia to interfere with education and encourage hundreds of Russian students to fly for educational refuge to the open arms of the German professor of "Kultur."

We hear from time to time of pettifogging local legislators at home who object to the use of rate-aided technical schools by the sons of those who live in other districts; the Municipality and University of Grenoble have, however, assisted in the formation of a Comité de Patronage des Etudiants Etrangers to assist foreign students, showing plainly that they do not share in such an infantile mentality as to object to students from elsewhere.

The University of Grenoble is one of the most go-ahead institutions in France, and it has been in front of other French universities in its efforts to provide accommodation for its students. The technical studies are centred at the regular and post-graduate courses, and owing to the inspired "puffing" which every feature of German life received at the hands of many professors and others, who looked upon the "Fatherland" as their terrestrial or "Spiritual" home, a large proportion of those who went abroad to study settled down at such places as Heidelberg, Charlottenburg, and Darmstadt.

An organisation has recently been formed, the Office National des Universités et Ecoles Françaises, to encourage the interchange of students of all ages between the United Kingdom and France. It is to be hoped that the movement will be successful, and that it will tend to remove that insularity, and some of that extravagance, which have often deservedly been urged against much of our work and methods at home.

Fig. 2.—Instruction in Testing Flow of Water at Grenoble University.

In recent years the French technical schools and universities have received very little attention from British students, and it can be said that the merits of the French system of education have been much more appreciated by the Americans than by ourselves, especially with regard to architecture. The French technical schools are noted on the Continent for hard work, and have never earned that reputation for "beer swilling" and "swashbuckling" which has for so long been a feature of German Polytechnic Institute; one important branch of work being devoted to electricity and hydraulics, and the other to applied chemistry, with special attention to electro-

chemistry and the production of paper. The town of Grenoble is situated in the centre of the "White Coal" district, and much of the activity in power transmission and electrochemistry in France has been due to the influence of this University; those, therefore, who become regular electrical students have facilities for examining some of the most up-to-date installations in the world.

Before the war it was somewhat the fashion to belittle the work of French electrical engineers and commercial men, and it must be said to their credit that they have not been experts at the blatant drum-banging of some of our trans-Atlantic cousins, or at the backstairs wire-pulling and peaceful penetration of the German Cartel Organiser. They, therefore, have not usually received the credit they deserved. Some of our officers who were in touch with French technical men during the war were astonished at the high standard of technical education and intelligence shown by many company directors, station engineers, and foremen.

At the present time, power transmission worthy of the name, and water power, are beginning to receive in the United Kingdom the attention they deserve, and for a full-time, or post-graduate, course there are few better centres for their study than the University of Grenoble. Our national finances are in such a state that we shall have little money to waste on fads and fakements, and one commendable feature of modern French work is the avoidance of unnecessary expenditure; the influence in the United Kingdom of a certain number of electrical men trained in France is likely, therefore, to prove valuable. The large amount of money raised in France for power transmission and allied work since the Armistice shows plainly that commercial men are not afraid of overhead lines, and do not doubt the integrity of their Government.

In France during the war over half a million horse power was developed from water power, and it is estimated that by the end of 1921 about a million kilowatts will have been installed. When it is remembered that during the war the only large project in the United Kingdom was shelved mainly because there was a danger that the promoters might reap some benefit out of it, it can be said that our national efforts up to date have been negative. It must be realised, therefore, that the more young men there are who have gone to see how things can be done, and have been done, the better.

There are four regular courses at the Grenoble University:—(1) The normal senior course of two years intended for those who have already a good knowledge of mathematics, physics, chemistry, and theoretical electricity. (2) A preparatory course intended for French and foreign students who have not sufficient qualifications to enter directly for the senior course. (3) A special one-year course for those who have qualified at other technical schools and wish to take specialised instruction. The latter course would be very useful to some of those who took part in the war and wish to bring themselves up to date before commencing or returning to practical life. (4) An elementary course in theory, design, and practical work intended for foremen and leading hands. It would be a good thing if some of our important Trade Unions could send a few of their young men to some of the leading trade schools in France, and not concentrate the bulk of their educational efforts on schools for grievancemongers, such as Ruskin College and Earl's Court.

The fees for the regular courses at the Polytechnic section of the University are moderate, and considering the value of the degrees and diplomas obtainable, the cost of education, including the cost of living, will be found very low.

The laboratories and workshops are well equipped with apparatus; five electric furnaces are arranged for carbide, ferro-silicon, and steel production, and allied work, and special attention is paid to the study of synthetic nitrogen products. Part of the power supplied to the Institute is delivered at 5,000 volts, and part from a neighbouring municipal power station which has been put at the disposal of the students by the municipality. Besides its activities in electricity and chemistry, the University is also well known for its courses of study in law, political economy, medicine, and literature.

For a number of years before the war the Comité de Patronage des Etudiants Etrangers had arranged short summer vacation courses dealing with the language, literature, history, and geography of France, special facilities being provided for English-speaking students; arrangements were also made for men and women past the usual student age who wished to "brush up" their French. The vacation courses start on July 1st, and continue to October 31st, but the instruction is arranged so that a commencement can be made at intermediate times, and short courses can be taken. In 1919 the vacation courses were attended by 447 students from all parts.

Arrangements are being made by which, if a sufficient number of British electrical students join the courses, some special lectures and excursions will be organised in connection with local power schemes and French electrical work generally; as about 20 electrical students have already sent in their names from one of the North of England technical colleges, there is little doubt that those who join these courses will have an interesting time. As the value of French technical journals and literature is beginning to be recognised, a working knowledge of French will prove useful to many engineers, and a vacation course should be a pleasant means to that end.

Arrangements are now being made for a six weeks' technical course to commence in August.

Grenoble is situated in the centre of a group of mountains forming part of the Alps, some of the neighbouring heights reaching to 10,000 ft.; there are facilities for sports of all kinds, a number of excursions being arranged by the Vacation Course Committee. The Foreign Students' Committee has prepared lists of rooms and *pensions* recommended for those attending the courses, the cost of board and lodging varying from 300 to 500 fr. a month; a student's hostel has also been provided at an inclusive cost of 190 to 225 fr. a month. The French Government is taking considerable interest in these vacation courses, in the hope that they will assist in the formation of the educational "Entente." The P.L.M. Railway will probably issue return tickets from Paris at single fare to those joining in these courses; those who wish to take part should remember that passports are necessary.

Mr. H. Sloog, A.M.I.E.E., of 45, Great Marlborough Street, London, W. 1, will be pleased to give information to those intending to take regular or vacation courses at Grenoble.

---

**Magnetic and Electrical Properties of Iron Nickel Alloys.**—A paper in the *Journal* of the A.I.E.E. deals with an investigation that was undertaken to determine whether any iron-nickel alloys could be found having a higher saturation value than pure iron; alloys were prepared containing 0-100 per cent. Ni, and to make them forgeable it was necessary to add alloying elements like Mn or Ti. The results showed that the saturation value decreased slowly with increase in Ni content up to 20 per cent., then rapidly to 30 per cent., and again rose rapidly to 50 per cent., and fell off gradually towards 100 per cent. Ni. At no point did it exceed that of pure iron. For values of $n$ between 100 and 400 the permeability was about 5 per cent. higher, for 6 to 8 per cent. Ni than for pure iron, but this advantage was offset by the large increases in hysteresis loss. Alloys containing 35 to 70 per cent. Ni had high permeability at low and medium densities and low hysteresis loss, the highest permeability occurring for 50 per cent.; 30 to 50 per cent. alloys were characterised by a nearly straight line $n$-$n$ curve from the origin to $n$=2,000 to 4,000 gausses, and also by low retentivity and coercive force, properties of value in connection with certain electro-magnetic meters. Previous investigations on commercial Fe—Ni alloys showed that 25 to 30 per cent. alloys had irreversible magnetic and electrical transformation points occurring below ordinary temperatures; the present investigation confirmed these results for pure alloys. A 30 per cent. alloy, annealed and cooled to room temperature, had its saturation value, $4\pi\iota_s$, increased from 2,500 to 17,800 gausses and its electrical resistance decreased from 81 to 32 microhms per cu. cm. after being cooled to liquid air temperature and reheated to room temperature. Alloys containing 15, 35, and 50 per cent. Ni showed practically no change after the above treatment. After allowing all transformations from the austenitic state to the $\alpha$ state to take place, the curves for $4\pi\iota_s$ and for electrical resistance both have definite cusps for 34.5 per cent. Ni, corresponding to the compound $Fe_2Ni$, thus giving evidence of the existence of this compound. It is pointed out that the irreversible transformation causes an enormous increase in the hysteresis loss.

# THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

## The Annual Convention at Ilkley.

(*Continued from page 803.*)

On Wednesday evening the annual dinner was held in the King's Hall, Ilkley, Mr. T. Roles presiding over a large gathering, which included many ladies. After the loyal toasts, the toastmaster delighted the audience by calling for silence for Major H. Richardson, R.E., M.I.*double*E., who, when the laughter had subsided, proposed "The City of Bradford and the Urban District of Ilkley," and paid a well-merited tribute to the hospitality of those municipalities. In the unavoidable absence of the Lord Mayor, Councillor Wilfred Turner, chairman of the Bradford Electricity Committee, responded, referring to the difficult times that the electricity department had gone through, under the able guidance of the President. He also drew attention to the announcement of the delimitation of the West Yorkshire electricity supply area, reported in our last issue. Mr. Eckersley (clerk to the Ilkley Urban District Council) also responding, expressed Ilkley's pleasure in being associated with Bradford—provided that the association stopped short of absorption. Mr. S. T. Allen (Wolverhampton), vice-president, proposed "Our Guests (including the Ladies)," and referred to the appointment of Sir John Snell as Chief Commissioner as highly gratifying to the I.M.E.A. Sir John, replying, said that the fact that the ladies accompanied their husbands greatly added to the pleasure and usefulness of the Convention, and dwelt on the advantage of the interchange of views at the Convention, which did more to promote economy and the public welfare than reading many books. He referred to Dr. Ferranti's prophetic forecast of the great development of electricity supply, which the war had accelerated, and rejoiced that Ferranti had seen his prophecy realised in part. The Commissioners had received most welcome assistance from the engineers of the country; Mr. Roles had presided over the conferences which led to the delimitation of the West Yorkshire area, in which plant of over a million kilowatts would be installed during the lifetime of some of those present. There would be an enormous expansion of electricity supply, and its relative price would come down, while the supply became more general. The cost of electrical apparatus would also fall. Regretting that he could not attend the presentation to Mr. H. Faraday Proctor, he ascribed to Mr. Proctor's labours, with the help of Alderman Pearson, the immense influence attained by the Association.

Mr. Ll. B. Atkinson (President-elect, I.E.E.) proposed the I.M.E.A., in an excellent speech. Pointing out that the only people who did not take the Association seriously were its own members, he declared that the support it received from the municipalities was absurdly inadequate; for lack of co-operation on the part of the local authorities, the generation of electricity was passing to the State, and if they did not wake up, the distribution would go too. Mr. Roles had suffered from ill-health during the past year, but had surmounted all his difficulties.

The President, in responding, said that in advocating better support, Mr. Atkinson had followed on the lines of his (Mr. Roles's) address; the I.M.E.A. had done great work, and could do greater still—but not without funds, staff, and municipal support. In view of Sir John Snell's remarks, he urged the Commissioners not only to sanction the inclusion, in the delegates' expenses, of the cost of bringing their wives with them, but also to disallow the expenses of a married man who did not take his wife!

Bailie W. B. Smith, O.B.E., proposed "The Electrical Manufacturing and Contracting Industries," and declared that he had no fear of "rings"; electrical manufacturers were right in agreeing amongst themselves, instead of competing fiercely and cutting prices too low for a reasonable profit. Mr. P. J. Pybus, C.B.E., in reply, said the B.E.A.M.A. was trying to standardise plant so that the prices of apparatus could be brought down; he saw both sides of the industry, manufacturing and municipal, and declared that corporations were paying less than the market price—young men would not enter the electrical industry because of the low rewards offered them, and the industry would suffer. Mr. P. Collinson (President, Electrical Contractors' Association) referred to the differences that had existed between the two Associations, and expressed a fear that the policy of the I.M.E.A. was to crush the contractors out of existence. But if they could get together the differences could, and would, be settled. Bradford had already agreed with the contractors, and got all it wanted without hurting them.

Mr. H. Faraday Proctor proposed "The President," referring to the difficulties of ill-health from which he had suffered; he had overcome them, with the help of Mrs. Roles, and brought about a Convention which was second to none. Mr. Roles, responding for himself and Mrs. Roles, said that the Association had no wish to crush the contractors.

On Thursday morning the Convention proceeded to Bradford by special train, and met in the Queen's Hall, where Mr. J. W. Beauchamp (director and secretary of the E.D.A.) read in abstract a paper on the "Standardisation of Tariffs." In the discussion Messrs. Purse, Dykes, Lieut.-Col. Vignoles, Messrs. Wordingham, Hoadley, Major Richardson, Messrs. L. L. Robinson, and Long took part, and Mr. Beauchamp briefly replied.

After a short interval the members re-assembled to witness a presentation to Mr. and Mrs. Proctor. Mr. Roles described it as the most pleasurable duty during his year of office; Mr. Proctor, after 15 years' service as hon. secretary, had been obliged to retire owing to the pressure of his duties not only to the Corporation of Bristol, but also to the surrounding district, and the Council, feeling that Bristol Corporation had been exceedingly generous, could not oppose his resignation. Alderman Pearson, hon. solicitor, and Mr. Proctor's chairman for many years, had also resigned. The Council could not let the occasion pass without some tangible recognition of Mr. Proctor's services; engineers and Committee members alike had willingly joined in raising a sum of £300, part of which had been applied to the purchase of a wrist watch and a Queen Anne silver tray. Alderman Jephcott, M.P., spoke of the sacrifices made by Mrs. Proctor on behalf of the Association and her invaluable assistance to Mr. Proctor, and announced that a dressing-case would be presented to her.

The President then formally made the presentation, and Mr. Proctor, in response, said he had been a member of Council continuously for 25 years, and it was always a very great pleasure to himself and his wife to do anything possible for the Association.

The members were then again entertained at an electrically cooked luncheon by the Electricity Committee of Bradford City Council, Councillor Wilfred Turner presiding.

Mr. Roles, proposing the health of the Bradford Corporation, expressed the thanks of the guests for the generous way in which it had entertained them; all the Committees had taken part in the preparations for the Convention.

The Deputy Lord Mayor (Councillor P. L. Craven), responding, said that the city had prospered, but the outlook now was not so good. Major Richardson toasted the chairman, who briefly responded.

Afterwards special tramcars conveyed the party to the Saltaire Mills of Sir Titus Salt, Bart., Sons & Co., Ltd., where the whole process of making cloth, from the raw wool to the dyed and finished fabric, was shown to the visitors. A reception was held at the Cartwright Hall, Lister Park, by the Deputy Lord Mayor, in the absence of the Lord Mayor, and after the guests had partaken of light refreshments and had been photographed in a group on a stand specially erected, they returned by special train to Ilkley. In the evening the "Committee" members held a private meeting, and the members of the Associated Municipal Electrical Engineers (Great Britain and Ireland) did likewise. The representatives of the B.E.A.M.A. meanwhile organised a social evening and dance, which was kept up until the small hours.

At Ilkley, on Friday morning, the annual general meeting was held, Mr. Roles presiding. The report and accounts were adopted, and the new members of council elected, namely: President, Major H. Richardson (Dundee); Vice-President, Mr. S. T. Allen (Wolverhampton); Engineers (large towns), Messrs. F. W. Purse (West Ham), A. Nichols Moore (Newport, Mon.), S. J. Watson (Bury), and J. H. Bowden (Poplar); (small towns) Mr. E. Calvert (Finchley); Committee members, Alderman Walker (Manchester); Alderman Sinclair (Swansea), and Alderman Bird (Birmingham). The hon. officers were re-elected. Major Richardson offered the Convention a hearty welcome to Dundee for next year, but in view of the difficulty of accommodating so large a gathering in an industrial town, the place of meeting was left for the Council to decide. Resolutions were adopted urging that the financial clauses of the Electricity Supply Bill should be passed as soon as possible; that the ownership and control of generating stations and main transmission lines should be placed in the hands of duly elected public representatives; that the Council should be instructed to consider the question of developing the sale of electricity, tariffs, &c.; and that all awards of the National Joint Board or Council should be loyally observed. A new scale of subscriptions was unanimously adopted, and votes of thanks were accorded to all who had helped in promoting the success of the Convention. Finally, a vote of thanks was given to the President and Mrs. Roles, to which Mr. Roles responded, drawing special attention to the assistance he had received from Mr. Senior, electrical engineer to the Ilkley Urban District Council.

For the afternoon an excursion in motor chars-à-bancs to Pateley Bridge and the Nidd Valley had been organised, and four car-loads took part in it. The remainder of the party began to disperse after the general meeting, which marked the close of a most successful Convention. The attendance in all exceeded 400, and 263 sat down at the annual dinner.

Correction.—On p. 803 of our last issue we said that Mr. Roles came into office as chief electrical engineer and manager of the Bradford electricity department in 1912; he has, however, occupied that position since 1907.

## The Design of Distributing Networks.

By C. A. GILLIN, A.M.I.E.E. (Bradford Electricity Department). (*Abstract.*)

(*Concluded from p. 807.*)

I (c). Cables and Methods of Laying.

All up-to-date undertakings have adopted paper-insulated lead-sheathed cables for general supply purposes.

For multiphase A.C. systems multicore cables are essential, and for D.C. systems they have become recognised as the best. Single-core cables, however, have one great advantage with regard to continuity of supply. In the case of faults it is usually found that single-core cables will burn themselves clear, and after severance, re-insulate themselves without taking sufficient current to blow the feeder pillar fuses. The continuity of the cable is broken, but often the continuity of supply is maintained, and, as usually more than sufficient evidence has been given of the existence of the fault, its location and repair is effected without much trouble. On the other hand, a fault on concentric or multicore cable almost invariably puts its section out of commission. Multicore cables are cheaper, very reliable, more convenient and adaptable, and the respective advantages of these two types occasionally make a choice of either a matter of delicate decision.

Solid systems have had their day. The chief disadvantages are: That due to shrinkage, the pitch or compound neither fills the troughing nor clings to the cable sheath, resulting in access of moisture and often both chemical and electrolytic action on the lead of the cable; the dissipation of heat is very slow, and cables cannot therefore be run safely for long periods at even an economical density; after a few years faults occur due to vibration crystallising the lead, which disintegrates and allows the moisture referred to above to penetrate into and ultimately destroy the insulation of the cable.

Conduit systems are good when used with discrimination. Their construction is most useful in situations where it is very probable that otherwise excavations will follow one another in rapid succession. Under other conditions it is cheaper to open out again; conduits usually cost more than re-opening ground. Another disadvantage is the decreased carrying capacity of the cables where drawn into ducts, due to the low rate of heat dissipation. It has been demonstrated that a difference of 50 deg. F. exists between the copper of a loaded cable and its duct wall. Messrs. Keating and Mueller give 35,000 K.V.A. as the maximum load any cable duct should be called upon to carry, most of their troubles having developed where this maximum has been exceeded. In spite of these drawbacks it is frequently expedient to make considerable use of ducts, and the choice of the most suitable is often decided by the circumstances of the case. Iron pipes are sometimes strongly advocated; if used they should be bonded at every joint and to the cable sheath (and armour) at each end. A very strong objection to their use is liability to weld to the cable after a fault. Stoneware ducts of various types are available. Fibre conduits are the greatest rivals of the above, and experience substantiates the claims put forward by their advocates. Both forms of conduit may be buried in concrete or not; in the case of a nest of them, it is necessary to employ concrete to maintain their alignment and position. One difficulty arising from the use of concrete is that workmen sometimes mistake it for the remains of an old building or wall and proceed to demolish it.

When the saving in space is a matter of importance, fibre conduits have an appreciable advantage. Stoneware ducts conduct away the heat more rapidly.

In connection with draw-in systems, the importance of well-designed manholes should not be overlooked. They should be built to prearranged approximate standards.

Lead-covered and armoured cables laid direct in the ground, and suitably protected against mechanical damage, are undoubtedly the best proposition when the ground is chemically suitable, *i.e.*, free from ashes and organic matter. It is advisable to protect the cables by layers of compound, commencing at the lead sheath, and well compounded tapes of suitable material. In addition, good soil should be used to protect the cables.

During the war, when the cost of armouring rose to a very high price, Bradford decided to dispense with the use of armour of any kind, for E.H.T. and all other cables. At normal prices, and where E.H.T. lead-covered cables are built with a copper earth sheath under the lead, the saving is not great. But why retain the copper sheath? It is never used with split-conductor and similar systems of protection. For 30 years unarmoured cables laid direct have been, and still remain, in continuous use in the centre of the city, and for over ten years there has not been a single fault on them. They formed part of the original two-wire system, and when the third wire was laid it was an armoured cable. Such few faults as have occurred in the district have been on the armoured cable, which in all cases is the positive; practically all these faults were a direct result of the effects on unbonded armour of other faults further afield. Precautions should be taken to prevent damage to the lead sheath by specifying alternate layers of a suitable compound and at least two layers of well compounded tapes. The ground should be naturally suitable or made suitable, and the use of shovels when putting on the first layer of soil should be strictly forbidden; the soil should be riddled over the cables, and no tools used except by one or two picked men until after the usual mechanical protecting material is in place.

For protection of cables from mechanical damage during subsequent excavations the following is suggested as the best order of reliability: Creosoted wood boards; reinforced concrete slabs; tiles; bricks. A thick board is a source of worry to a man trying to dislodge it, not only on account of its length, but also due to its resistance to the withdrawal of a pick driven into it. Even when almost rotten, its presence suggests exploration. A concrete slab is its most effective rival. Brick suggests nothing but bricks.

Two reasons for allowing more space between cables than is customary are liability of damage to sound cables, due to faults on adjacent cables, and the necessity for making reasonable allowance for dissipation of heat. In each case the pressure is the most important factor, particularly when 20,000 to 30,000 volts is in question, as the heat due to dielectric hysteresis at high voltages and rising temperatures is very considerable. The maximum safe temperature of the copper in cables working up to a voltage of 11,000 is 150 deg. F. Below 11,000 volts a somewhat higher temperature may be allowed for. Cables working at their most economical carrying capacity would in general be well within the safe temperature limit, but under emergency conditions (which are becoming chronic) it is useful to know to what extent risks may be taken. The energy loss in the dielectric and its effect on transmission and distribution economy do not appear to be appreciated at their true values. For instance, on a 3-core 0.25 sq. in. cable carrying 250 amps. at 30,000 volts, 50 periods, at a load factor of 40 per cent., the dielectric energy loss is nearly 40 per cent. more than the $C^2R$ loss. Up to about 150 deg. F. the dielectric loss is proportional to the temperature, but afterwards increases rapidly. As it is also nearly proportional to the square of the voltage, it is obvious that lower current-carrying values and increased spacing distances must be adopted as the voltage is increased. The correct spacing of cables is a matter of the highest importance, and should vary from about 8-in. for L.T. to 2 ft. 6 in. for 20,000 to 30,000 volts.

Overhead lines have a few advantages, of which continuity of supply is not one. Taking into account wayleaves, repairs, upkeep, renewals, and higher rate of sinking fund, their cost is not much (if any) less than underground construction. After the first few years their maintenance is very heavy—not twice, as is frequently stated, but many times the cost

of underground construction. The only justification, with a few exceptions, for their provision is in those cases where a considerable reduction in route distance results, or over ground not suitable for underground cables.

### I (*d*). Jointing, Bonding, and Earthing.

Properly made, a cable joint should have as good a factor of safety as a cable. A "married" joint, properly sweated by using a metal pot, insulated with unbleached tape boiled in a suitable oil compound and put on hot, will generally be satisfactory up to 10,000 volts. Above this pressure it may be advisable to use porcelain spreaders in addition. Expansion joints may be useful in some districts, but unless the cables are persistently overloaded beyond their safe limit, or ground subsidence is a common occurrence, they do not seem to be necessary. Faulty joints are sometimes the result of cutting too deeply when taking off or trimming back the lead sheath. When insulating the joint, the tape should be drawn tightly at every turn to avoid air pockets, and in damp weather should be occasionally basted with the sleeve filling oil compound heated to 230 deg. F. This should always be done before putting on the lead sleeves. An efficient sleeve of chemically pure lead of reasonable weight, plumbed on to the sheaths of the cables with wiped joints and then filled with suitable viscous compound, should make the joint equal in stability to the cable. Provision should also be made against the effects of faulty plumbing by enclosing the joint in a box filled with a bitumen compound. If the cables are armoured, the armour should be bonded to the lead at every joint. Many faults have been caused by neglect of this precaution, as the result of arcing between lead and armour due to fault currents from a distance. Probably inefficient bonding of the armour, &c., has been responsible for more cable interruptions than any other single cause. One of the best forms of bonding armour is that used by Messrs. Henley on all their boxes, &c. A very successful bond can be made by tinning the armour and plumbing it on to the lead sheath by a wiped joint. This requires very careful workmanship, otherwise the bond (like many others) is worse than useless, as divorce is caused by heavy fault currents, arcing results, and additional faults are thereby created. Inefficient bonding is far worse than no bonding at all. Advantage should be taken at all points where several cables meet to bond together all their lead sheaths and armour.

One particular point in each supply area should be adopted as a point of hypothetical zero potential and connected directly to the points at which the neutrals at the generating stations are earthed through their resistances.

The earthing of the neutrals and star-points of L.T. systems is compulsory, and if it is not now common practice in the case of E.H.T. systems it should be, as the whole system is thereby stabilised, surges are minimised, and the voltage to earth being reduced increases the factor of safety.

The earthing of the neutral in three-phase, four-wire A.C. district distribution is a matter upon which considered opinions would be appreciated. So long as one transformer chamber supplies its own district there is no difficulty, but a time sooner or later arrives when the L.T. networks of adjacent districts have to be paralleled. Earthed neutrals in more than one place on the same system invite the circulation of currents due to harmonics. It is usual to earth at only one chamber in the centre of a group, but what is to be done when all districts ultimately merge into one group? One point only seems inadequate unless insulated cables are to be run to various parts of the system from it and connected to the cable sheaths.

### I (*e*). Accessories.

Generally speaking, the detail work of such things as pillars, street boxes, joint boxes, service terminal boxes, &c., is scrappy, badly designed, made of indifferent metal, badly finished, unskilfully fitted, and they are put on the market with an apparently fatuous insensibility to their unfitness. Common defects are lack of essential lock-nuts, &c., defective or inefficient soldering of connections in isolating switches, current transformers, relays, &c.; bad contacts and insufficient contact area; small sectional areas and low conductivity, &c. Some of these imperfections may not give visible results until after the plant has been in commission for a considerable time, and their consequences often obliterate the cause of the troubles.

Feeder and section fuse pillars should be selected very carefully before being adopted for extensive use, as it is essential that all fittings, fuse jaws, and fuse handles should be interchangeable and satisfactorily perform their functions. Sloppy cables and under-rated connections out of sight make provision for trouble. For heavy networks, fuse jaws are invariably deficient in both sectional area and contact surface; the consequent heating-up sometimes causes sectional interruptions at most inconvenient times.

Disconnecting boxes should be safe, impervious to moisture, easy of access, and readily handled, most of the time occupied in restoring a supply after clearing a fault being used up in opening, disconnecting, and closing these boxes. Every link should be robust, have ample and efficient contact surface, and point definitely in the direction of the cable it controls. Simplicity is most appreciated on a dark wet night; intricacy of construction and assembly, if it conduces to simplicity of operation, is far preferable to constructional simplicity and obscure operation.

During the last few years failures have been mitigated by building around each gland where the cables enter a brick box, and filling it with compound.

None but very high-grade compounds should be used in joints or boxes. A good compound should be chemically stable and neutral; tough but not brittle over a wide range of temperatures; have a high melting and softening point; be non-hygroscopic; free from ash, grit, or scum; and have high dielectric strength, hot or cold. Its coefficient of expansion should be as low as possible, and its tendency to stick tenaciously to cast iron as high as possible. The latter will be helped if boxes are previously painted with bitumastic paint.

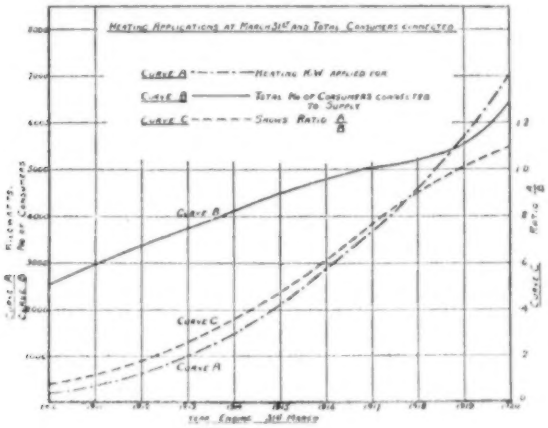

Heating Applications at March 31st and Total Consumers connected.
Curve A ——·——·—— Heating K.W. applied for
Curve B ———— Total No. of Consumers connected to Supply
Curve C - - - - - Shows Ratio A/B
Curve A
Curve B
Curve C
Curve A
Curve B
Curve C
Ratio
1920 Engine Still Moved

Fig. 8.

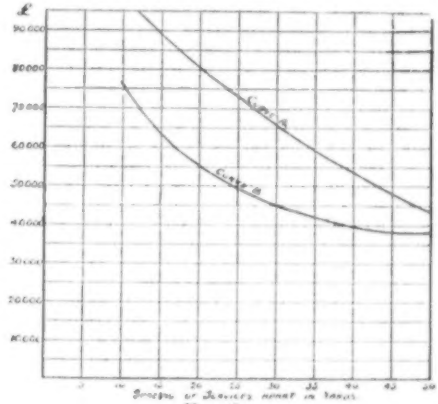



Fig. 9.

### The Best Means of Meeting Future Demands for Electrical Energy.

Constructive foresight in network design is a matter bristling with difficulties, as the magnitude of future demands is quite unknown, but they are going to be very heavy. These demands, so far as general heavy industrial supply is concerned, can be quite satisfactorily dealt with as outlined in section 1; but provision for those loads which may be expected in the future on the medium pressure supply networks is another matter altogether. Every house will have electric lighting; 70 per cent. of them will have an electric radiator; the electric washing machine has a future now undreamt of; cooking is bound to boom; irons, pans, grills, toasters, are already extremely popular. The curves in fig. 8 show the applications received for heating apparatus by the City of Bradford during the last eleven years. The figures represent known installations, and probably should be increased by 50 per cent. Curve C represents the ratio of K.W. of heating to total number of consumers connected, and is very significant.

In the business and shopping districts the small motor is replacing all hand-operated mechanism; office and shop fireplaces are gradually becoming anachronisms. Coincident with these movements is the modern tendency in the direction of higher buildings of many stories; these large blocks are going to provide a huge future load in radiators and energy-consuming devices (in spite of central heating arrangements), which may easily reach 500 to 1,000 K.W. each. Are they to be treated like large individual consumers and given an E.H.T. supply with a meter room on each floor to which each consumer will run his wiring? In some cases this will be the best proposition if suitable arrangements can be made, but

in other cases, where every ten or twenty yards loads varying from 1 to 100 kilowatts are required, the solution must be a different one. For the sake of economy the district loads must be delivered by E.H.T. mains at 20,000 volts, or over, to centres, and from these distributed to various feeding points. In A.C. districts the distribution would be effected by 6,000- or 11,000-volt mains supplying transformer chambers, each of which would in turn supply its own limited area, but the ultimate demands will in all probability be so heavy that the transformer chambers would have to be very close together. Their cost, accommodation, and number would seem at first sight to be prohibitive, but further investigation shows this to be the best method where practicable.

D.C. areas would either have to be scrapped or numerous heavy D.C. feeders would have to take the place of the 6,000 to 10,000-volt cables, unless these could still be used by employing improved mercury-arc rectifiers in similar chambers to those in A.C. districts. Combined with E.H.T. distributors the efficiency of rectifiers at fairly high load factors compares favourably with medium-pressure feeders, but they would add £10 per KW. to the capital cost, which would go a long way towards the cost of changing over the system entirely to A.C., and they require attendance.

The only alternatives to the installation of large numbers of transformer chambers, &c., are larger L.T. cables or higher pressures at the consumers' services. Larger mains than those now in use are objectionable, and it also follows that larger loads would be dislocated when faults occurred. One is therefore forced to the view that the solution must be found by the adoption of higher pressures, which in turn must involve either (*a*) the use of transformers at all services, (*b*) the adaptation of lighting and other apparatus to those higher pressures, or (*c*) the use of a system of distribution consisting of primary and secondary cables with transformers of a sufficient capacity installed wherever necessary. After careful examination (*a*) will be found to be prohibitive on account of the extremely high cost of services each with a separate transformer, (*b*) is in the hands of the future and no doubt will come to fruition earlier than most people expect, (*c*) appears to be a popular American stunt when a factory builds around it a mushroom town, and should be useful in the case of large residential blocks.

The curves in fig. 9 have been prepared to show the relative costs of supplying an area of one square mile by (curve A) 3-phase, 4-wire, 400/230-volt mains fed from 6,600-volt transformer chambers, and (curve B) supplying the same area by 3-phase, 3,000-volt mains with a 3,000-v./400-v. or 230-v. transformer for every four services. Although the latter is shown to be cheaper, the former is the better commercial proposition because it includes the further advantage of making use of the 6,600-volt mains for supplying large demands along the same routes, and, of course, its advantages would be still greater if a pressure higher than 400/230 volts were applicable. In each case it has been assumed that a distributing centre is available in the district. Curve A includes the necessary transformer chamber equipments, with duplicate transformers, and the cost of half the buildings, the other half being presumed to be on existing premises, and one 6,600-volt split-conductor cable laid along the same route and at the same time wherever a medium pressure is provided for; but curve B provides for one 3,000-volt main only and the necessary transformers. Both curves include the cost of fuse pillars, switch pillars and services, and 8 miles of mains.

Advantage should be taken of increasing the load-carrying capacity of all cables and other plant by seizing every opportunity of improving the power factor. Raising the power factor of the load on a cable from 0.5 to unity increases the load-carrying capacity of the cable 100 per cent., from 0.6 to unity 67 per cent., and from 0.7 to unity 43 per cent., the losses and regulation remaining the same in each case. Conversely, for the same KW. load the losses at 0.7, 0.6, and 0.5 power factors would be respectively 2, 2.7, and 4 times the losses at unity power factor.

It is almost impossible, except in extreme cases of very low power factor, to induce consumers to install synchronous motors, phase advancers, condensers, &c.

Tariffs in all cases should be arranged so that the proportion due to standing charges increases in definite ratio to the decrease in power factor. The capital charges on the steam side of a supply undertaking are unaffected by low power factor except in so far as the additional output to compensate for extra losses at peak load is concerned, which may be neglected in practice. The increased capital charges on the remaining station plant, however, are not inconsiderable, and in a fairly large station would be increased 44 per cent. to supply a power load operating at 0.7 power factor, compared with the same load operating at unity power factor. For the same circumstances the capital charges on distribution would be doubled, as these costs vary inversely as the square of the power factor. It is obvious, therefore, that in tariffs the standing charges should not only be based on K.V.A. demand, but that equitable treatment justifies a rising increase per K.V.A. as the power factor decreases.

Single-phase welders and furnaces are becoming very popular in this country, and in a year or two thousands of the former will be in common use. Their power factors vary from 0.3 to 0.6 and their loads are erratic. The method of charging for the energy supplied to them deserves consideration at once, and should surely be based on at least three times the K.V.A. demand plus a flat charge per unit used.

### TRANSFORMER CHAMBERS.

Transformer chamber buildings must be situated in dry, clean places, or made dustproof, otherwise fluff prevents satisfactory operation of switchgear, relays, &c. Dirty insulators are a continual source of expense, and dampness increases maintenance and operation costs. They should be built of solid material, or rats, mice, &c., gain access, and mischevious persons may cause trouble.

Roofs and buildings must be strong and fireproof to protect apparatus from damage due to fire, collapsing adjacent walls, &c.

To comply with the foregoing, buildings must be of stone, brick, or other suitable material, and have a reinforced concrete roof rendered waterproof by being asphalted. Experience shows brick buildings to be the cheapest and most satisfactory.

The *design* of buildings can only be standardised to a limited extent, the buildings themselves not at all except for certain sizes and suitable location. The design of the building and its size depends on the type of switchgear used, whether single-phase or three-phase transformers are installed, and not least, on its position in relation to the generating stations or distributing centres, *i.e.*, to the short-circuit value of its location, as this factor will influence the size and design of its switchgear.

Standardisation of parts of buildings can easily be, and should be, adopted. Such parts are ventilating louvres or grids, concrete bricks or blocks with holes cast in for rag bolts and other fastenings to be cemented or leaded in.

The provision of adequate ventilation is the most important item in chamber construction. The dissipation of the heat due to transformer losses requires on the average approximately 350 cubic feet of air per minute per KW. loss for oil-cooled transformers and 70 to 90 cubic feet of air for air-blast-cooled transformers.

As in the case of buildings, so also with regard to equipment is any attempt at hard and fast standards undesirable. Supply authorities who are in a position to do so buy from different manufacturers such items as they find most suitable for their requirements and assemble them in their own workshops at little more than half the cost of those purchased complete.

As the size of the generating station and the area of supply increase it becomes expedient to adopt two or three different sizes of oil switches for use at corresponding impedance distances from the generating stations, their rating depending upon the total amount of running plant on the system. They might have breaking capacities of, say, 50,000 K.V.A., 150,000 K.V.A., and 300,000 K.V.A. Installing the oil switches too small for their duty is simply squandering money.

Standardisation of switchgear, if not impossible, is at least inadvisable except within definite limits. Until manufacturers standardise their gear, and decide how to rate it intelligently, supply authorities must remain free lances.

In designing the arrangement of transformer chambers, one ought to commence at the generating station and adopt a uniform method of notation, relative arrangement, and colouring of phases. The same sequence should be observed in the cables, throughout the switchgear, and at the transformer terminals. Then on the low-tension side of the transformers a similar sequence should be followed out, and likewise through the L.T. distributing or control boards to the L.T. cables, network boxes, fuse pillars, and the cut-out boxes on consumers' premises. The importance of this from the standpoint of the operation staff cannot be too strongly emphasised.

[ERRATUM.—In our last issue, p. 806, figs. 5 and 7 should be interchanged.]

---

### DISCUSSION.

The discussion was opened by Mr. C. H. WORDINGHAM, who remarked that the mains were the most costly and important item in an undertaking, but had not been so much in evidence as the generating plant at such meetings. In the case of a large area under the national scheme, the transmission mains alone might cost more than the generating plant, in addition to the distributing network. If suitable cables were available, the pressure would be higher than 33,000 volts. He preferred 10,000 to 6,000 volts for feeders. The Research Committee was obtaining most interesting results with regard to the carrying capacity of underground mains. "Earthing" was a wide question, affecting not only the mains but also private installations; the principle laid down in the report of the I.E.E. Sub-Committee on earthing would involve great expense in carrying it out, and he thought it would be better to use leakage cut-outs, to prevent the earth current from exceeding a moderate value. He strongly objected to the author's proposal to raise the pressure on consumers' installations; for large motors, &c., a high pressure was the right thing, but not for small consumers and domestic appliances. Earthing cooking utensils and irons was a nuisance, and might have the opposite effect to that which was intended. If, on the other hand, the supply pressure were reduced to 50 volts, all wiring regulations could be relaxed, and the installation greatly cheapened, a most desirable result, even if it cost a little more to give the supply.

Mr. STANILAND (Hornsey), referring to the author's condemnation of the solid system, said that lead-covered cables

laid solid near a tramway had suffered damage, and the soil was not suitable for laying cables direct in the ground; but by laying armoured cables on the solid system all the difficulties were overcome, and in 15 years there was only one fault. He had used transported soil to protect cables, but after a time that precaution failed to have effect. He did not agree that bricks were ineffective as a protecting covering.

Mr. F. AYTON (Ipswich) disagreed with Mr. Wordingham regarding the supply pressure, and pointed out that electricity was incomparably less dangerous than gas. With regard to the continued use of low-pressure direct current, he hoped that the mercury vapour rectifier would solve the problem, and in a few months he would have a rectifier sub-station in operation.

Major BELL (Hull) regarded the proposal to dispense with armouring as heterodox; it would impose upon the lead sheathing a function that it was never intended to perform. If the author was right, the cost would be reduced, but if he was wrong, the result of following his advice would in a few years be horrible to contemplate. In laying down heavy cables in anticipation of a future load, difficulties arose in connection with protecting devices; either these in the early stages would be too large to be effective, or they would have to begin with small ones and replace them later with larger ones, a matter of no little difficulty and expense. In the United States all the big companies retained their D.C. network in use, not increasing its area but adding to its load; he doubted the suggestion that a gradual change-over to A.C. would take place, though naturally A.C. would be used in the outer areas. He agreed with the author that the advantages of overhead mains were more than outweighed by the drawbacks; farmers had a rooted objection to granting wayleaves, and the necessity of placing the poles in dykes or fences made a pole line look like a "Chinese fence." The designs of sub-stations shown by the author appeared unduly expensive. Manufacturers' phraseology with regard to the rating of switches was open to criticism; what did "a breaking capacity of 300,000 KW." mean?

Mr. S. E. FEDDEN (Sheffield) congratulated Bradford on the excellence of its mains department as evidenced by the author's paper. He preferred to generate at 11,000 volts, and had never had a breakdown due to the use of that pressure, which allowed of the adoption of a handy size of cable for 5,000 KW. over a 10-mile radius. He would step up to 60,000 volts when the cables were available. The only suitable protection for heavy feeders on a large system was the split-conductor, with the possible addition of the Hunter-Beard system; capacity currents upset the other methods on a large system, but they were useful for protecting transformers, &c., connected to the system. He preferred not to exceed a sectional area of 0.25 or 0.35 sq. in. in cables. The largest houses were not necessarily the largest consumers; some small houses took 25 KW. Undoubtedly there was going to be a big boom in electric cooking, and it was most difficult to know how to deal with it. With regard to the earthing question, it would be most disastrous to have a large system all coupled up together; they might couple up lightly, or provide means for coupling up when necessary. He agreed absolutely with Mr. Ayton with regard to the safety of electricity. For protecting mains laid in bad ground, he recommended the use of clay; wood was scarce, and he was using slabs made of ash concrete for covering cables. The power factor of big rolling-mill motors was extremely low—some as low as 0.3. For domestic supply, he used 200 volts, and would not exceed 250; but for big motors and rotary converters he used 11,000 volts, and for motors of medium size 3,300 volts.

Mr. PURSE (West Ham) described, with illustrations, a daring type of sub-station which he found in use at West Ham; the transformers were not surrounded by brickwork, the room being open to the air, and only the switchgear was completely enclosed. The design was cheap and good, and had given satisfactory results over a period of 12 years. To examine the transformers, they were rolled out from under cover.

Mr. WATSON (Bury), referring to the condemnation of overhead mains both last year and at the present convention, said he and others had considerable lengths of O.H. lines at 6,000 and 11,000 volts; justice had not been done to that system. The capital cost was reduced, and the mains could be carried over ground where underground cables could not be used except at great expense. With 10 years' experience of 10 or 12 miles of E.H.T. lines at 6,000 volts, he found that the maintenance cost was not excessive; continuity of supply was not quite so good, but the restoration of service was much more quickly effected than with underground cables. In the future overhead mains *must* be used, if many of the distant points were to be supplied. It was unwise to belittle the advantages of O.H. lines; the question must be considered on its merits, and in many cases there was no alternative. The duplication of E.H.T. mains was a matter of the first importance. Under war conditions it had not been carried out, and for individual consumers it was not always commercially possible, but in some cases, such as bulk supply from one authority to another, it was indispensable. Transmission by E.H.T. polyphase current was now standard practice, and all large schemes should extend on the polyphase system; the cost of changing-over large existing D.C. systems was too great, but they should not be extended. The Board of Trade required that only one point of a system should be earthed, and in his opinion each district should have a separate supply; it was better not to interconnect the low-pressure networks.

Mr. J. H. C. BROOKING (Cable Works, Warrington) said that dispensing with the use of armour was a very momentous decision; no other system was running on those lines. Success depended largely on continual attention to maintenance. Practice was liable to change as one mains superintendent followed another; when they had a good mains man they should stick to him. All other classes of plant received immediate attention when faulty, but troubles on the mains showed their effects years after the cause occurred. He had seen one authority pulling out a system at the same time that an adjoining authority was putting it in. Inefficient bonding was worse than no bonding at all.

Mr. WEBBER (Keighley) had had serious trouble with cables laid on the solid system, with wooden bridges; minute faults occurred two feet apart for miles. The cables had been down 10 years, and there were three or four faults every week, with thousands to come. He agreed with the author that ordinary armouring was of little use; it would not withstand a navvy's pick, and it was a troublesome job to joint armoured cable. He considered that overhead cables would not survive; they gave no trouble in summer, but lots of it in winter.

Dr. S. Z. DE FERRANTI drew attention to the intensive propaganda in favour of gas, which was cleverly organised; but electricity required no such assistance to attain success. They had to consider the cost of getting the electricity to the consumer, and the uses to which he would put it; the mains were so important that the greatest possible amount of work should be done on them. The problem was not to get the present amount of electricity to the consumer at a lower price, but to supply him with a vastly greater quantity at a price not much higher than at present. He recalled the fact that 31 years ago the London Electric Supply Corporation had not only to devise but actually to make paper-insulated cables; present-day practice justified that decision. Twelve miles of those original mains were still supplying London at 10,000 volts.

Mr. GILLIN briefly replied to the discussion, and was accorded a hearty vote of thanks for the paper.

---

A golf competition was one of the features of the meeting. It was the second of the kind only, the first being held in June, 1914, at the Warmley course, during the Birmingham Convention. This produced only a dozen competitors, whereas the Ilkley competition brought 31, including two ladies, into the field. It might be worth while to introduce into next year's I.M.E.A. Convention programme a golf competition of a more official kind, as so many are now interested in the game, and there are few business associations that do not have such a competition annually or even oftener.

Messrs. J. K. Brydges and W. G. Pickvance acted as the Organising Committee for the competition, and everything passed off smoothly. A silver cup was contributed anonymously, and an optional sweepstake added to the interest of the competition, which was played on the excellent links of the Ilkley Golf Club on the Wednesday and Thursday afternoons of the Convention week.

Mrs. J. K. Brydges presented the prizes to the following:—

| | | | |
|---|---|---|---|
| Brown, W. A. (Pirelli) | ... | ... | 93–17= 76 |
| Silver Cup and 1st sweepstake prize. | | | |
| Woodhouse, Mrs. W. B. | ... | ... | 119–36= 83 |
| Midgley, H. E. (English Electric) | ... | | 91– 8= 83 |
| 2nd and 3rd prizes divided. | | | |
| Other competitors returned cards as follows:— | | | |
| Dickinson, H. (Liverpool) | ... | ... | 96–15= 81 |
| Speeding, T. (Sunderland) | ... | ... | 100–14= 86 |
| Heath, P. M. (Hon. Solicitor) | ... | ... | 98–12= 86 |
| Brydges, J. K. (Eastbourne) | ... | ... | 101–14= 87 |
| Bond, F. (Battersea) | ... | ... | 91– 4= 87 |
| Preece, G. L. (Bruce Peebles) | ... | ... | 96– 9= 87 |
| Christie, J. (Brighton) | ... | ... | 113–24= 89 |
| Deverill, A. G. (Brush) | ... | ... | 105–14= 89 |
| Stone, G. D. (Mirrlees) | ... | ... | 107–18= 89 |
| Starkie, J. E. (Burnley) | ... | ... | 103–14= 89 |
| Brooking, J. H. C. (C.T.S.) | ... | ... | 104–12= 92 |
| Ferguson, R. F. (Hastings) | ... | ... | 109– 6= 93 |
| Pickvance, W. G. (Wrexham) | | ... | 117–20= 97 |
| Clothier, J. (Bootle) | ... | ... | 111–10=101 |
| Brown, W. A., Mrs. | ... | ... | 132–27=105 |
| Symonds, G. | ... | ... | 132–18=114 |

Other competitors, who evidently forgot to return their cards, were Messrs. Angus, Davidson, Dexter, Hunter, Irving, Jackson, Lunn, Marshall, Milnes, Naylor, Rowse, and Torpey.

We are indebted for these particulars to Mr. J. H. C. Brooking.

---

**E.T.U. and Kinema Wages.**—For some time the Electrical Trades Union has been at loggerheads with the Sussex branch of the Cinematograph Exhibitors' Association on the question of wages demands. At last month's meeting the demands put forward on behalf of the operators were rejected, and Mr. J. Webb, London district secretary of the E.T.U., warned the C.E.A. of the possible consequences. The C.E.A., at a meeting on June 19th, decided that a sub-committee be set up and authorised to negotiate terms of wages and hours with representatives of the E.T.U., subject to confirmation by the general meeting.—*Daily Herald*.

## NATIONAL HEALTH INSURANCE ACT, 1920. NEW RATES OF CONTRIBUTIONS AND BENEFITS.

BY JOS. J. H. STANSFIELD.

BY an Act which received the Royal Assent on May 20th, 1920, the rates payable under the National Health Insurance Act, 1911, in respect of employed contributors, have been increased.

The Act will, except as otherwise expressly provided, come into operation on July 5th, 1920, or on such later date, not being more than 12 months later than May 20th, 1920, as the National Health Insurance Joint Committee may appoint, and different dates may be appointed for different purposes and different provisions of the Act.

A memorandum (266/X) has just been issued under which the weekly contributions payable for employed contributors in Great Britain will be increased as from July 5th, 1920. The new rates are as follows, the rates payable under the Act of 1911 being also given for comparison :—

| | 1920. | 1911. |
|---|---|---|
| For male contributors ... ... | 10d. | 7d. |
| For female contributors ... ... | 9d. | 6d. |

In the case of exempt persons (that is, employed persons to whom certificates have been granted) the rate has been increased to 5d. per week.

Employers must stamp workers' cards from July 5th, 1920, this date being the commencement of the second half-yearly period of 1920.

In the case of employed contributors, the employer may make deductions as follows :—

| | 1920. | 1911. |
|---|---|---|
| Men ... ... ... ... ... | 5d. | 4d. |
| Women... ... ... ... ... | 4d. | 3d. |

but when a worker aged 18 or upwards is not in receipt of board and lodging from the employer, and the rate of remuneration does not exceed 4s. a working day, the amounts that may be deducted are :—

| | |
|---|---|
| For remuneration over 3s., but not over 4s. a working day. | Men, 4d.<br>Women, 3d. |
| Below 3s. ... ... ... ... ... | Nothing. |

In the Act of 1911 it was provided that Parliament should pay a certain part of the contributions in the case of low wage earners. This provision now ceases to have effect.

The ordinary rates of benefit are to be increased from the before-mentioned date as follows :—

| | 1920. s. d. | 1911. s. d. | Per week. |
|---|---|---|---|
| Ordinary rate of sickness benefit :— | | | |
| Men ... ... ... | 15 0 | 10 0 | " |
| Women ... ... ... | 12 0 | 7 6 | " |
| Sickness benefit before 104 weeks from entry and payment of 104 contributions :— | | | |
| Men ... ... ... | 9 0 | 6 0 | " |
| Women ... ... ... | 7 6 | 5 0 | " |
| Disablement benefit :— | | | |
| Men and women ... ... | 7 6 | 5 0 | " |
| Maternity benefit ... | 40 0 | 30 0 | |

The new rates do not apply to schemes in force which have been approved by the Registrar of Friendly Societies under Sec. 72 of the Act of 1911, and the Minister of Health may cancel certificates already given in respect of provision for employment under the Crown or any local or public authority, or in the service of a railway or other statutory company where the terms are less favourable than those now provided under the new Act, and for the same reason schemes of approved societies may be revoked. New certificates may, however, be given, or new schemes approved on application.

Sanatorium benefit, except as regards Ireland, now ceases to be included among the benefits conferred by the Act of 1911.

Sub-section (1) of section 10 of the National Insurance Act, 1913, which relates to the benefit of voluntary contributors, has been amended, and £250 is now substituted for £160.

In the memorandum it is pointed out that employers are required to pay contributions (*a*) for non-manual workers where the rate of remuneration does not exceed £250 per year, and (*b*) for manual workers whatever may be the rate of remuneration.

---

**Licensing Electricians in South Africa.**—The Tramway and Lighting Committee of the Johannesburg Municipality recommends that the authorities of the South African School of Mines and Technology be requested to take over the conduct of examinations for the licensing of electricians on the conditions outlined by the principal of that institution at the meeting of the Board of Examiners held on December 3rd, 1919; and that the By-laws for the Licensing and Regulating of Electricians within the Municipality be amended by the deletion of the words "examining board" and the substitution therefor of the words "licensing board."—*S.A. Engineer and Electrical Review.*

## ELECTRICALLY DRIVEN PUMPS.

AT the summer meeting of the INSTITUTION OF WATER ENGINEERS, held on June 10th, 11th, and 12th, at Birmingham, under the presidency of Mr. F. J. Dixon (chief engineer to the South Staffordshire Waterworks Co.), Mr. C. F. BEKENN, A.M.Inst.C.E., contributed a paper on "The Application of Turbine-pumps to Water Supply." In the course of the paper the author remarked that while turbine-pumps could be driven by any type of prime mover, he placed the electric motor in the first place as regarded efficiency and convenience. The installation costs, including foundations, were low, and the space occupied was small. The pump and motor required very little attention as the bearings were automatically lubricated with oil-rings. Low installation costs permitted the sets to be conveniently distributed. They were easily started up, and could also be operated from a distance or automatically stopped and started, either by varying levels in the reservoir or by varying pressures between pre-determined limits. The alternating-current motor was preferable to the direct-current machine owing to the absence of a commutator, and most of the installations at work were driven by A.C. motors. If a heavy current rush on starting was permissible, it was advisable to install squirrel-cage motors, as the turbine-pump, owing to its low starting torque, could easily be started up by this type of motor. One point that had to be noted was that the slip between synchronous and asynchronous speeds could not be exactly determined, and might vary as much as 2 to 4 per cent. The B.H.P. required to drive the turbine-pump varied as the cube of the speed, so that should the slip be less by, say, 2 per cent. than the makers' original estimate, the B.H.P. would be considerably increased, with a proportionate increase of water. For squirrel-cage motors auto-transformer starters of the oil-immersed type should be installed, with no-volt and overload release on the three circuits, these operating in the stator circuit. The starter consisted of a transformer with tappings on the windings, of varying percentages of the line voltage. The tappings should be selected as best suitable for the starting torque, and as that was not more than 50 per cent. of full load torque, a low percentage, say, 25 per cent. or 30 per cent., was sufficient. The automatic features were arranged in the "running" position only, because, in the "starting" position they would at once break the circuit owing to the rush of current, which was generally two or three times the ordinary running current. This type of starter only required three terminals on the motor and six on the starter, namely, three for the motor and three for the line. In cases where low starting currents were necessary slip-ring motors should be installed, as those would start up with 50 per cent. of full load torque using normal running current. With reference to motor terminals, trifurcating boxes were recommended as providing an extremely neat finish and effectively enclosing all the live parts. In large pumping-stations, where the current had to be carried some distance and the motor-power was at least 150 B.H.P., the motors could be wound for 6,000 volts, and so dispense with transformers. For motors of less than 150 B.H.P. a lower voltage was necessary on account of the difficulties of insulation in the coil windings.

Proceeding to discuss the relative costs of steam and electric pumps, the author gave several examples as showing that economy was on the side of the latter. Thus the City of Hereford had three electrically-driven pumps working off a three-phase, 50-cycle circuit, two sets delivering 60,000 gallons per hour, and the other set delivering 90,000 gallons per hour, against a total lift of 120 ft. in each case. The costs, as recently determined, showed that with electricity at 0.75d. per unit, the cost of electric pumping was 0.5d., as compared with 0.426d. per 100,000 gallons, the cost of steam pumping. Those figures included men's wages, lubricating oil, waste, &c. The Newbury District Water Co., early in the year 1912, made careful tests of its compound condensing steam pumps, and of its electric pumps. The latter were driven by direct-current motors, one set having a capacity of 30,000 gallons per hour against 185 ft. lift, one set 20,000 gallons per hour against 150 ft. lift, and a further set 3,000 gallons per hour against 164 ft. The 1912 costs worked out at 1.18d. per 100,000 foot-gallons for steam, as against 0.957d. for electrically-driven pumps, but for 1920 the figures are 2.61d. and 1.576d. respectively. The Chester Waterworks Co. had installed a Diesel engine and dynamo supplying power to drive turbine pumps built by Sulzer and the Rees Roturbo Co., at two separate stations connected by cable. The costs, including all transmission losses and "shut-downs" due to interruption in working consequent on erection of additional plant, came to 0.657d. per 1,000 gallons, 100 ft. lift.

In the course of a discussion on the paper, Mr. F. STORR, chief engineer to the Chester Waterworks Co., remarked that in the case of a pump efficiency and reliability should come first, and those were points which were not by any means properly appreciated by either the makers of electrical plant or the turbo pump, and probably not by all users. When it came to the question of generators and motors the blighting influence of the lowest tender was apparent in all electrical work. Everything had been cut down to the finest limit, with the result that efficiency and reliability in working were sacrificed. The mistake generally made was that manu-

facturers did not by any means realise the extreme importance of high efficiencies. It was usual to refer an inquirer to the catalogue when purchasing a pump, but his advice to water engineers was to have their pumps made for the particular duty they had to perform. At Chester, when the question of the adoption of electrically-driven pumps was under consideration, the importance of high efficiency was strongly pressed upon the makers, price being a secondary consideration. Eventually they obtained a pump from Messrs. Sulzer Bros., of Winterthur, who guaranteed 80 per cent. efficiency for the pump and 89 per cent. for the motor. The make of motor was left entirely to Messrs. Sulzer Bros., and they paid a high compliment to British manufacturers by selecting that made by Messrs. Lawrence, Scott & Co. On the trial run the specified efficiencies were attained, and they had been maintained within a point or two during the 5¼ years the plant had been in operation. The pump had only been opened out once for examination, and from the date it commenced to run up to the present day not one penny had been spent on repairs of either the pump or the motor. They could, therefore, well understand why he was in favour of turbine pumps. When the question of a duplicate pump came up for consideration the war was still on, and of course the purchase of foreign plant was out of the question. Under those circumstances some English makers were approached, and eventually Messrs. Gwynne's, Ltd., of Hammersmith, took up the matter, and agreed to design a pump which they guaranteed should equal if not excel the efficiencies stipulated. The firm had been highly successful, and the Chester Water Co. was now in possession of an English-made pump which gave slightly over 82 per cent. efficiency on the test bed. Taking the quantity of water pumped, the double lift, and assuming an over-all charge of 1d. per Board of Trade unit, every one per cent. of efficiency lost or gained represented a capitalised value of £666. It was, therefore, obvious that the company could afford to pay well for specially designed plant to meet its special requirements. The author had referred to the costs of running the pumps "including all transmission losses" as being 0.657d. per 1,000 gallons per 100 ft. lift. That figure was double that which obtained in 1914. The explanation was that at Chester there were two pumping stations, distant about 400 yards from each other. When the electrically-driven turbo pumps were decided upon it was found expedient to generate all the electricity at the works, where the Diesel engines were fixed, and connect the two works by cable. Unfortunately the works were separated by a main road along which the Corporation electric tramways were laid. The Corporation owned the electricity works, and when the question of using electrical energy for pumping was under consideration, the Corporation was approached as to the terms upon which it would supply the company. Unfortunately, the price and conditions offered were prohibitive, and the company had no alternative but to generate its own current. On that becoming known, the Corporation strongly objected to the company opening the streets, and obtained an injunction to continue in force during the war against its so doing. The company was then face to face with the position that it must either have costly plant lying idle and continue to use obsolete steam plant, or else assent to the terms imposed by the Corporation, which practically meant that the water supply would be controlled by the Electricity Committee. Fortunately the company had two water mains connecting the pumps at the two works. It was decided temporarily to disconnect one of the mains and pass through it a special twin cable made by the Helsby Co. That was done by floating a copper ball through to which a cord was attached. Through connection having been established the drawing through of the special cable was a comparatively easy matter. The necessary connections of main and cable were then made, and the supply of water through the main was resumed. That arrangement had been in operation some four years, and was quite satisfactory. The voltage drop was somewhat in excess of that usual for the length of cable between the two works, but that had now been reduced to a very reasonable limit, 3½ per cent. At Chester they were determined to go ahead with turbine pumps. Had it not been for the Diesel engines and the turbine pumps his company would not have been able to pay a dividend; by following the course described, it was able to pay the maximum and have a little over.

## BUSINESS NOTES.

**The "Electrical Review" Index.**—The Index to Vol. 86 of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for sixpence post free. Any reader or advertiser, at home or abroad, who requires a copy for binding or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.4.

**Engineers' Wages.**—According to the Labour correspondent of the *Daily Telegraph*, the claim of the Engineering and Shipbuilding Trade Unions for a further large advance in wages was to be presented to the Industrial Court for consideration and decision on Tuesday. The present demand is possibly the heaviest which has ever been submitted. It asks for an advance of 6d. for each hour worked. This is the main claim; but in addition there are several subsidiary claims, including a standard wage of £6 per week, and the doubling of the rates of pay, including overtime pay, for week-end work. On the main wage claim, the proposed increase of 6d. per hour means an addition of 23s. 6d. to the present wage. "It can be forecasted with accuracy that the present claim will be strenuously opposed by the employers as putting a burden upon the cost of production which would exclude British productions from markets in which our products had to compete with those of America." The writer refers to the steady rise in wages in these industries as compared with the pre-war rates of wages. The most recent award of the Industrial Court was issued on January 27th, and gave an advance of 5s. per week to all workers of 18 years and upwards. The difference between the present earnings and the pre-war earnings, is as follows:—

| | Weekly wages. Aug. 4th, 1914. | Feb. 20th, 1920. | Increase. Per week. | Per cent. |
|---|---|---|---|---|
| Engineering:— | | | | |
| Fitters and turners ... | 38s. 11d. | 82s. 5d. | 43s. 6d. | 112 |
| Ironmoulders ... | 41s. 8d. | 85s. 6d. | 43s. 10d. | 105 |
| Patternmakers ... | 42s. 1d. | 86s. 8d. | 44s. 7d. | 106 |
| Labourers ... ... | 22s. 10d. | 63s. 11d. | 41s. 1d. | 180 |
| Shipbuilding:— | | | | |
| Platers ... ... | 40s. 4d. | 83s. 4d. | 43s. 0d. | 107 |
| Rivetters ... ... | 37s. 9d. | 80s. 5d. | 42s. 8d. | 113 |
| Shipwrights ... ... | 41s. 4d. | 84s. 6d. | 43s. 2d. | 105 |
| Labourers ... ... | 22s. 10d. | 63s. 7d. | 40s. 9d. | 178 |

**Italian Foreign Trade Catalogue Enterprise.**—An example of the enterprise of certain foreign firms is shown in the activities of a well-known Italian electrical and general engineering concern, who have decided to issue catalogues, &c., printed in French, Spanish, Portuguese and Italian, descriptive of their leading products. It is also proposed to publish and distribute catalogues, &c., in the languages of Greece, Serbia, Switzerland, Bulgaria, Russia, Brazil and Palestine. It is intended to distribute these among all electricity supply authorities and power stations in these countries.—*Board of Trade Journal.*

**Dutch Co-operative Trading.**—The Co-operatieve Inkoop Vereeniging van Metaal Industriaellen (Co-operative Purchasing Association of Metal Manufacturers), of Rotterdam, which had 101 members in 1919, and which also supplies iron and steel, machinery, and plant, &c., to non-members, has just issued its report for last year. The report states that the prices for electrical plant began to decline at the beginning of 1919 in connection with the increasing imports of raw materials, and copper, cables, transformers, motors, &c., became considerably cheaper. In the second quarter, prices were fairly constant, but in the second half of the year they rose regularly and continually. Many orders for cables, transformers, meters, wire, &c., were placed in England at the commencement of the year, but as raw materials arrived in Holland in greater abundance, the Dutch works were again able to compete with foreign manufactures, the result being that most of the orders in the second half of the year were allocated to Dutch firms. Moreover, the Germans gradually re-entered the market, and in the final quarter they willingly accepted orders for cables at "very competitive prices." The Association's turnover in electrical plant in 1919 amounted to £648,000.

**Shut Down.**—The *Star* states that MESSRS. LYON, WRENCH & CO., electrical engineers, of Willesden, N.W., have shut down their works. The business has been transferred to other works. The reasons given are difficulty of obtaining raw material and "the policy of the Government in matters of finance." The factory was erected during the war. Some 300 men are affected. The output was dynamos and electric motors. "There is an almost unlimited demand at the present time for dynamos and electric motors," said an official, "but additional working capital is very difficult to obtain at the present time. Then there was the founders' strike, which kept back materials all over the country, though we personally have not had any trouble with our employés."

**A Desk Folder.**—We have received one of the "Pel" folders for keeping together in handy accessible and easily-movable form, loose desk papers, music, &c. It has the merit of being a simple and strong, but most convenient, contrivance, and naturally makes an additional appeal to us because it is the invention of an electrical man. The covers have supports raising their outer edges several inches from the desk, and the papers are kept loose for withdrawal or rearrangement. The name "Pel" is derived from the claim that the folder *dispels* muddle and *compels* efficiency. It is supplied by MESSRS. MANIFOLDIA, LTD, of 23, Holborn Viaduct, E.C.1.

**Not Smoke Abatement.**—About three months ago Messrs. Dick, Kerr & Co., of Preston, started the experiment of allowing their men to smoke for 15 minutes each morning and afternoon without any stoppage of work. The scheme has proved so successful that henceforth the men will be permitted to smoke from 9.30 to 11 a.m. and from 2.30 to 4 p.m.—*Daily News.*

**Wages in Sweden.**—In the course of a report on the commercial and industrial situation of Sweden for 1919, H.M. Consul at Stockholm gives the following among other increases of wages between 1913 and 1918 :—

| | Average yearly wage. 1913. | 1918. | Per cent. increase between 1913 and 1918. |
|---|---|---|---|
| *Metal and engineering.* | £ | £ | |
| Men ... ... ... ... | 73 | 146 | 100 |
| Women ... ... ... ... | 36 | 70 | 95 |
| *Power, light and water installations.* | | | |
| Men ... ... ... ... | 72 | 157 | 117 |
| Women ... ... ... ... | 35 | 75 | 111 |
| *Transport.* | | | |
| Men ... ... ... ... | 67 | 151 | 125 |

Official inquiries into the cost of living show that there had been a rise of 159 per cent. between July, 1914, and December, 1919.

**An Austrian Company.**—The report of the A.E.G. Union Electricity Co., of Vienna, states that orders for industrial purposes were brisk in 1919, and the undertaking was abundantly supplied with work for a long time forward. It was probable that the electrification of the railways and the extension of the use of water power, which were only to be proceeded with provisionally to a small extent, would afford occupation for the works in the future. The net profits increased from 1,450,000 kr. in 1918 to 2,419,000 kr. last year, and a dividend has been declared at the rate of 8 per cent., being the same rate as in 1918. It is intended to increase the share capital from 36 to 50 million crowns.

**British Manufacturers in South Africa.**—The newly-formed South African Association of British Manufacturers and their Agents, formed in Johannesburg with the object of safeguarding the interests of United Kingdom manufacturers in South Africa, and generally of promoting British trade interests in the Union, held its first annual meeting on April 27th, when the title of the Association and its draft constitution and rules were adopted. The aim of the Association is not to supersede existing British trade organisations in South Africa, but to strengthen them by effective co-operation :—

1. To provide an organisation which can represent and speak for British manufacturers as a body, and which through trade sections can equally represent a particular branch of British industry.
2. To concentrate the energies of any existing organisations in South Africa working to protect British trade interests, and at the same time provide an organisation wide enough to embrace all types of genuinely British firms with their representatives or branches, whether these carry stocks or samples or tender to specification.
3. To provide adequate local representation for the many Manufacturers' Associations now in existence in the United Kingdom, and to make possible a linking up with the similar Associations of British Manufacturers and their representatives in Australia and Canada.
4. To protect the interests of British manufacturers on the spot.
5. To provide His Majesty's Trade Commissioner in South Africa with an Advisory Council, and through the trade sections with technical advice, to nominate at their request expert arbitrators and surveyors in cases of dispute where British goods and British firms are involved.
6. To provide advice and guidance for British manufacturers, and to collect information on trade matters at their request.
7. To co-operate with the British Standards Committee.
8. To see to it that when the time is ripe for particular industries to be located in South Africa, British capital and British plant are available for their development.

At present the only office of the Association is in Johannesburg, but it is proposed later to open a branch at Cape Town, and also to institute a considerable number of trade sections. In order that the Association may be made as representative as possible, it is suggested that any United Kingdom manufacturers interested in trade with South Africa, who are not already members, should consider the desirability of joining. Membership is confined to United Kingdom manufacturers and their South African agents, and all applications for admission should be addressed to the Secretary (Mr. B. Silcock), Goldfields Building, Eloff Street, (P.O., Box 5,644), Johannesburg.

Copies of the constitution and rules of the Association may be seen on application at the Inquiry Room at the Department of Overseas Trade in London, or a copy will be sent on loan to any firms in the provinces who may be unable to call there.

**Shawinigan Power.**—The D.O.T. in London has received, and has available for inspection, a pamphlet relating to the activities of the SHAWINIGAN WATER AND POWER CO., and the possible additional development of the company, which it is thought may be of interest to United Kingdom electrical manufacturers.

**Government and Industry.**—In the course of his speech at the annual meeting of Petters, Ltd., at Yeovil, Mr. E. W. Petters said that so far one had failed to see any indication of improvement in the Government attitude towards industrial enterprise, which it appeared to treat with callous indifference, while at the same time, industry was expected to provide the means for meeting the country's great obligations. Nothing had happened since the war to injure the trade of the country so much as the present Budget, which had struck deeply at the foundations of the credit upon which industry was based. In these days when the normal conduct of business put a strain on managers, such as they had never before experienced, it was against human nature to expect the energy and the enterprise which were necessary for the successful carrying on of undertakings when at the same time the undertakings were robbed of the credit upon which they relied, and were taxed beyond endurance. The speaker went on to show that a 60 per cent. E.P.D. plus income-tax at its present rate on balance was a burden altogether too heavy to be borne, and was the greatest contributing factor to the present high prices.

**The Institute of Cost and Works Accountants, Ltd. (by Guarantee).**—The first annual general meeting of this Institute was held at the Hall of the Chartered Patent Agents, Staple Inn Buildings, Holborn, W.C., on June 4th. Mr. R. J. H. Ryall, F.C.W.A., the chairman, in submitting the Council's report and accounts, congratulated the Institute on the fact that, in spite of the difficulties of the post-war organisations, the membership had steadily grown. The increase in membership was such that, during the three months subsequent to March 7th, 1920, it was equal to the whole of the income for the past year, which, taking into consideration the fact that all applications for admission to the Institute had been most carefully scrutinised, and that over 60 per cent. of the applicants had been deferred until such time as they could prove, by examination, their suitability, was most gratifying and encouraging for the future. The Right Honourable Lord Leverhulme, P.C., had accepted the presidency, and the following had become vice-presidents :—Sir Robert Hadfield, Bart., D.Sc., F.R.S.; Sir Charles W. Macara, Bart.; Sir Gerard A. Muntz, Bart.; Sir Herbert Austin, K.B.E., M.P.; Mr. Nevile Gwynne, Mr. W. Howard Hazell, and Mr. H. W. Allingham.

The Chairman further gave a *résumé* of the various meetings and lectures held by the Institute. The Chairman expressed, on behalf of the Council, great appreciation of the work done by the hon. secretaries of branches, which had already been formed at Birmingham, Manchester, and Glasgow, strong programmes and lectures, &c., being arranged at these centres for the coming session. Branches at Sheffield, Bristol, Newcastle, and other cities were in course of formation. The Chairman pointed out to all members the importance of standardised costing systems and the definition of terms used in this most important profession. A Special Committee to deal with this subject was being formed, and would be assisted by Sub-Committees created in all manufacturing districts. A number of other Committees had also been brought into being to deal with various subjects. The examination syllabus had been extended by the inclusion of law subjects, and candidates entering for the examinations of, and subsequent to, December, 1920, would have to satisfy the Council of a thorough knowledge of the various Acts which affect factories and workshops, &c.

Mr. J. Martin Blair, M.I.E.E., is secretary of the Institute, and its offices are at Donnington House, Norfolk Street, Strand, W.C. 2

**Annual Outings.**—The annual outing organised by the employés of MESSRS. MCWHIRTER & SONS, LTD., Cardiff, took place on Saturday last. The day was spent at Ogmore, on the Glamorgan Coast, the journey being made by char-à-bancs. After luncheon, Mr. C. Matthews (chairman of the committee) proposed the toast of the firm, to which Mr. A. C. McWhirter responded. During the afternoon, sports occupied attention, keen interest being taken in all the items, which included 100 yds. open race, egg and spoon race, high jump, needle race, boys' race, blind race, and long jump. During the evening the prizes were presented by Mrs. A. C. McWhirter, and a musical programme followed.

On June 19th the employés and a number of friends of the Paisley Corporation Electricity Department went to Campbeltown by the *Queen Alexandra*, and most of the company journeyed thence by the light railway to Machrihanish. High tea was served at Campbeltown, and Mr. W. Blair Smith, the engineer and manager, in the course of an address, expressed the hope that now that the outing had been resumed after a postponement of five years, many more would follow. Mr. Henderson (Babcock and Wilcox, Ltd.) thanked the committee, and Mr. Savage, station superintendent, replied.

The employés of MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, Huddersfield, went for a char-à-bancs outing to Buxton last week.

The second annual outing since the War, of the employés of MR. P. T. KING, electrical engineer, of Luton, took place on Saturday last. An enjoyable day was spent at Southend. The staff took advantage of the opportunity to present Mr. King with an illuminated address expressive of their appreciation of his efforts to foster good relations between employer and employed.

The third annual outing of the staff, employés and guests of the BENJAMIN ELECTRIC, LTD., of Tottenham, was held on Saturday last. The party, numbering well over a hundred, went by motor chars-à-bancs to Brighton. Dinner and tea were served at the Aquarium.

HENLEY'S had a day in the country on Saturday, June 12th, when Henley Cables and Henley Tyres blended in an outing by chars-à-bancs to the Surrey Hills. The 227 members of the head office staff from Blomfield Street and New Union Street spent the day at the lovely village of Ewhurst, where lunch and tea were taken at the Bull Hotel.

**The Elba Dry Cell.**—We have received from MESSRS. JONES & PORDES, of 8, Crawford Passage, Farringdon Road, E.C. 1, a sample of their "Elba" dry cell, which is being placed upon the market. The cells are of full size, being 2½ in. in diameter, and standing 6¼ in. high. It is pleasing to see that they are fitted with two screw terminals; the troublesome old "rat's tail" form of terminal is not used. These cells are of British make, and amongst the advantages claimed for them by the makers are exceptional storage capacity and a long life in use. The latter claim is borne out by the fact that the particular cell sent us, although made over 12 months ago, still gives 10 amperes.

**Electric Wire Standardisation.**—The Accessories and Components Committee of the Society of Motor Manufacturers and Traders has appointed a Sub-Committee to meet representatives of the Cable-Makers' Association on the question of the standardisation of electric wires.

**For Sale.**—Lincoln Corporation Electricity Department invites offers for two 50-KW. Laurence-Scott, D.C. generating sets direct-coupled to Willans & Robinson condensing engines, also a Gwynne centrifugal motor-driven pump. Full particulars are given in our advertisement pages to-day.

**Bankruptcy Proceedings.**—Edward Stirling Elam and John Walton (trading as Elam, Walton & Co.), 63, King Edward Street, Kingston-upon-Hull, electricians.—The first meeting of creditors herein was held on June 25th at Hull. Debtors' statement of affairs showed liabilities in the joint estate of £339, and net assets of £114. They attributed their failure to "want of capital," inexperience in the business carried on, and a loss of £50 through a fire which took place at their premises on April 20th last. The matter was left in the Official Receiver's hands.

**French Company Notes.**—Messrs. Henri Guedelin and René Mathelin-Moreaux have formed themselves into a company at Paris (Rue Rude 6). with a capital of 100,000 fr., for the manufacture, fixing, and repair of electric automobile apparatus.

Under the style of Société de Construction de Matériel électrique, Démarreurs et Appareillage, has been formed at Paris (14, Rue d'Anjou), a company, with 400,000 fr. capital, for the manufacture, trade, and representation of all kinds of electrical material.

Les Isolants Français is the title of a company formed at Paris (21, Rue d'Uzès), for the making and sale of all kinds of insulators, especially ebonite. The capital is 1,100,000 fr. in 500 fr. shares, 500 of which are allotted to M. Tersen, as payment for his assets.

With the denomination of Société des Forces électriques de la Vallée de Gavarnie has been formed at Paris (41, Avenue de l'Opéra), a company with a capital of 1,000,000 fr., for the generation and supply of electricity.

With a capital of 850,000 fr., P. Hinstin and A. Lehmann have established themselves as a company at Paris (7, Rue Darboy), for the manufacture and sale of articles pertaining to electricity.

The Electricité Appliquée announces its change of name to Self (Société d'Electricité pour la Lumière et la Force), retaining the same offices, 103 and 105, Rue Saint Lazare, Paris.

Increase of capital from 14,000,000 to 20,000,000 fr. has been decided upon by the shareholders of Energie Industrielle, in view of the absorption of the Electrique de l'Orléanis.

The Etablissements Paz et Silva have decided to raise their capital from 2,500,000 to 10,000,000 fr.

**Strikes.**—A correspondent says that a strike is in progress at the Prescot Works of the British Insulated and Helsby Cables, Ltd., said to have arisen through some irregularity in the clocking-on arrangements. Following the dismissal of two men, 2,000 men and women members of the General Workers' Union ceased work, and by last Saturday (June 26th) no fewer than 4,000 men and women were unemployed. It was reported that if the matter were not settled within a few days the firm might close down the whole of their works for an indefinite period.

At Southport, last week, some 40 electricians, members of the E.T.U., struck work because the Southport masters had declined to meet the official negotiating body of the Merseyside, to which the Southport Branch is affiliated, in respect of the formation of a set of rules and rates for Southport.

**Company Liquidations.**—British Gauge Manufacturers' Association, Ltd.—Winding up voluntarily. Liquidator, Mr. B. G. Arthur, 97, Cannon Street, E.C. Meeting of creditors held June 30th.

Rotasphere Co., Ltd.—Winding up voluntarily, "in view of the financial position . . . due to the recent moulders' strike and want of capital." Liquidator, Mr. A. S. Jopp.

**Dissolution of Partnership.**—C. Redman & Sons, machine tool makers, Parkinson Lane, Halifax.—Messrs. T. J. and E. S. Redman have dissolved partnership as from October, 1918.

**Book Notices.**—We have received a copy of a most interesting book, entitled "The London Assurance: 1720—1920," by G. S. Street. It has been issued by the London Assurance Corporation on the occasion of the celebration of its Bicentenary. It is attractively produced, and in these very different days it is restful, refreshing, and very amusing to read of insurance doings in the days of long ago.

"The *Electrician* Tables of Electricity Undertakings" (102 pp.). London: Benn Bros., Ltd. Price 10s. net.—The 1920 edition of this valuable work has been divided into more sections than previous issues. Lists are given of undeveloped provisional orders and projected supply schemes. Russian and Argentine undertakings are classified in separate tables.

"Essai de Machines et d'Appareils Electriques." Part 1. By Barbillion, Jolland, and Lafont. 268 pp., 164 figs. Paris: Bibliothèque de l'Ingénieur-Electricien.—This is the first part, dealing with continuous current only, of a description of the experimental methods employed at the Institut Polytechnique de Grenoble. The work is essentially practical, and covers a wide area, dealing with general first principles, dynamos, motors, illumination, &c., &c.

"B.B C. Mitteilungen." Vol. VII. No. 3. March, 1920. 83 pp.—Baden, Switz.: Brown, Boveri & Co.

**E.P.D.**—The Chancellor of the Exchequer was to meet the representatives of the Federation of British Industries yesterday, Thursday, to discuss the concessions to the Excess Profits Duty which have been recommended by the Federation of British Industries.

**Porcelain in Germany.**—The Syndicate of German Electrotechnical Porcelain Works announces that customers and consumers frequently complain of high prices charged for porcelain for electrical and other technical purposes. The situation of the market is being closely followed by the syndicate, which, however, states that a reduction in prices cannot be made at present, as wages and raw materials have recently again experienced an increase.

**Catalogues and Lists.**—Athol Engineering Co., 9, Peru Street, Higher Broughton, Manchester.—Priced leaflet of transparent polished sheet celluloid.

Messrs. F. L. Mitchell & Co., Ltd., 188, Rye Lane, Peckham, S.E. 15.—Temporary illustrated list of wireless instruments No. WT 10 (12 pp.). A comprehensive priced catalogue of amplifiers, transformers, H.T. units, condensers, &c. Also a description, priced, and illustrated of the "Mark E 1" receiving set.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, W.C. 2.—Bulletin 27s., illustrating and describing a sphere-gap voltmeter, and giving a table of sphere-sizes for various voltages.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Pamphlet No. O 2,290 (8 pp.) illustrating and describing the "C.M.I." magneto. Also Leaflet K 2,331 giving revised up-to-date prices of telephones, switchboards and accessories.

The Wardle Engineering Co., Ltd., 195, Deansgate, Manchester.—Catalogue No. 12 (44 pp.). An illustrated and priced list dealing with electric light lanterns, reflectors, and fittings for all commercial purposes. The introduction gives a number of useful notes on illumination.

**Trade Announcements.**—The United Electrical Co. (Birmingham), Ltd., has removed from 8, Newhall Street, to 47, Summer Row, Birmingham.

Mr. W. E. Weekes and Mr. Chas. H. Clarke have entered into partnership, and are carrying on business as electrical contractors, specialising in private telephone work to the trade, under the title, W. E. Weekes & Co., at 50, Tottenham Court Road, W. 1.

The J. G. Brill Co. have removed from Cannon Street to 150, Southampton Row, London, W.C. 1. Telephone: "Museum 5313"; Telegrams: "Axles, London."

Mr. F. Husband last week ceased his connection with the business of Messrs. Electrical Industries, Ltd., of Pancras Lane, E.C. Communications intended for Mr. F. Husband personally should be addressed to him at 4, Grange Road, Gunnersbury, W. 4.

## LIGHTING AND POWER NOTES.

**Bath.**—Year's Working.—The accounts of the electricity undertaking for the year ended March 31st last, show a total revenue of £35,547, as against £28,743 for the previous period. The total expenditure was £28,888, as against £22,807, leaving a gross profit of £6,659. Loan charges, &c., amounted to £10,779, causing a deficit of £4,120, compared with a loss of £4,850 for 1918-19.

**Bingley.**—Year's Working.—The result of the working of the electricity undertaking for the past year was a deficit of £860. The payment of loan charges, &c., increased this to £1,598.

**Blackburn.**—Year's Working.—The total revenue accruing to the electricity department for the past financial year was £91,321, and expenditure amounted to £70,744, leaving a gross profit of £20,557, as against £16,898 for the previous period. The payment of loan charges, sinking fund contributions, &c., resulted in a net loss of £345, comparing favourably with last year's deficit of £2,226.

**Bolton.**—Extensions.—The Electricity Commissioners, impressed with the growing demand for electricity in Bolton, have suggested an extension of Back-o'-th'-Bank generating station beyond the immediate intentions of the Committee. The present capacity is 16,000 KW. A 12,000-KW. set and a 6,000-KW. set are on order. It was suggested to the Commissioners that another 12,000-KW. set should be substituted for the 6,000 set on order, bringing the total capacity to 40,000 KW. The Commissioners expressed the opinion that it would be a mistake to get rid of the 6,000-KW. set, and that it would be a better policy to extend the buildings so as to enable a second 12,000-KW. set to be installed, bringing the total installation to 46,000 KW. This would involve the extension of the boiler house, further boilers and other extensions to buildings, costing double the amount already decided upon—£370,000. The electrical engineer is reporting on the suggestion

**Brierfield.**—Loan.—The Council is applying for permission to borrow £5,000 for the extension of mains and services.

**Burton-upon-Trent.**—Year's Working.—The total income of the electricity department for the year ended March 31st last was £53,523, as compared with £34,955 in the previous period; the total of working expenses was £36,970, compared with £21,255, and the net profit, after payment of interest, taxes, &c., was £1,428, a decrease of £3,830 compared with last year's profit.

**Chile.**—Oil-Fired Power Station.—A 50,000-KW. oil-fired steam turbo-generator station supplying power through a 110,000-volt transmission line to copper mines in Chile is described in a paper by Mr. P. H. Thomas, read before the American Institute of

Mining Engineers. The Tocopilla power house of the Chile Exploration Co. is of specially substantial construction to withstand the effect of earthquakes and is in an area where practically no fresh water is available. Oil fuel is pumped through a pipe line laid out on floats from boats anchored off the shore, as there is no harbour, and is stored in three 55,000-gal. tanks. Marine type water-tube boilers are used with short steel chimneys with forced draught, and all feed water is distilled from the sea. Circulating water is also taken from the sea and special precautions have to be taken to prevent the ingress of seaweed. The generating plant consists of five 10,000-K.V.A. 5,000-volt three-phase alternators. The voltage is stepped up by transformers to 110,000 volts for the 90-mile transmission to the mines. The sub-station at the mines converts to direct current partly by synchronous motor-generators and partly by rotary converters.—*Technical Review.*

**Clayton.**—AMALGAMATION.—Whilst a number of surrounding townships are strenuously opposing the Bradford proposed extension scheme, Clayton is anxious to join Bradford. The terms of agreement, reached by representatives of the two places last week, and subject to acceptance by the full local authorities, include the construction of a tramway by the Bradford Corporation and the supply of electricity to Clayton within two years after amalgamation. With regard to the clause relating to the supply and distribution of electricity, details were left to the Bradford electrical engineer.

**Continental.**—BELGIUM.—It is reported from Brussels that the strike of gas and electricity workers at Namur has ended, the men having agreed to accept arbitration.—*The Times.*

Although feeling the effects of the economic depression, the working results of the Electricité de l'Escaut for last year showed an advance. Consumption of electricity had increased in most of the communes served, 24,037,000 KW.-hours being supplied, contrasted with 13,178,000 KW.-hours in the foregoing year. Many new contracts for the supply of power to big industries had been concluded, and others had been arranged, including one for the supply of electricity to the suburbs of Antwerp. The 5,000-KW. turbo-generator set carried off by the Germans had been recovered and placed in service again, and further extensions of the plant were under consideration.

FRANCE.—An important programme of extensions, under way or projected, is engaging the attention of the Omnium Français d'Electricité. It is erecting low-tension networks for the towns of Laval, Thouars, Avranches, Langres, and Chartres, a network to supply the outskirts of Granville, and a 60-km. 30,000-volt transmission line between Avranches and Granville. This line will supply electricity to the latter town, instead of drawing it from the thermic station there, as hitherto. The new supply will be obtained from the Ducey works belonging to the Société Anonyme des Forces de la Sélune, with which the Omnium has concluded an agreement. Among the projected schemes are a 15,000-volt tranmission line from Dreux to Chartres, and similar lines from Alençon to Fresnay-sur-Sarthe, La Hutte, and Beaumont. Other projects are a 30,000-volt feeder, on account of the Société de l'Electricité de l'Ouest, from La Chataigneraie to Saint Vincent Sterlange, passing through Chattonay; a 30,000-volt line from Faymoreau to Parthenay and Thouars, and a 20,000-volt line to supply Samois, Fontaine-le-Port and Chatelet-en-Brie in the outskirts of Fontainebleau. In Normandy a 30,000-volt line to run between Aubes (Orne), Mortagne, and Nogent-le-Rotrou, is under consideration; and in the Department of Ile-et-Vilaine, a 30,000-volt line between Rennes and Dinan, to supply the latter town with extensions to all parts of the Department. The outlay on these several works will total from 10,000,000 to 12,000,000 fr.

The *Journée Industrielle* adds the following particulars of the plans of this company to cover the Departments of the Yonne and the Nierve with a huge network for the supply of electricity for lighting, power, and traction purposes. (1) A group of three hydro-electric stations developing a total power of 15,000 H.P., each station designed to feed one of the three sections of the railway network. The first will be built at Bois de Cure, and will yield 12,000 KW. from an 85-metre fall. The second, on the Chaulaux, will give 7,000 KW. from a 75-metre fall. The third, on the Laurel, will furnish 8,000 KW. from a 155-metre fall. The transmission lines will probably be equipped for 65,000 volts. (2) A network of electric railways of 1-metre gauge, having a length of 200 km., divided into three main sections. The first will comprise a line from Avallon to Chastelux-Lormes, with branches to Saint-Léger-Vauban, and a line, Avallon-Pontaubert-Vézelay-Châlet-Censoir. The second section will be formed by a line, Auxerre-Sainte-Colombe-Toucy. The third section will comprise a line, Auxerre-Tonnerre, and a line, Courson-Châtel-Censoir, linking with the first two sections. The concession stipulates that the first section and the harnessing of the fall which will serve it shall be finished in three years, and the whole of the programme in nine years—three years for each section. The cost is estimated at 150,000,000 fr.

SPAIN.—The Spanish Government has recently granted concessions for the establishment of plant to utilise the water power of the river Asteasu, near Guipuzcoa, and the river Cardevias, near Baduran, for the generation of electricity.

**Coventry.**—YEAR'S WORKING.—The Electricity Department of the City Council showed a working profit for the past year of £57,739. Capital charges absorbed £47,951, leaving £9,788 net profit. This sum, with £266, brought forward from last year, makes a total surplus of £10,054. It is proposed to place £6,900 to the reserve fund, the balance to be carried forward.

**Dublin.**—MUNICIPAL OFFICIALS' STRIKE.—Fears were entertained that when the members of the Municipal Officials Union employed by the Corporation went on strike last week for the Civil Service bonus award, the electricity undertaking, among other public utilities, would be interfered with, and work suspended. The Strike Committee, however, decided against this, and, in any case, it is understood the workmen would have refused to act with the higher officials had a contrary ruling been made.

**Epsom.**—LOAN.—The Urban District Council has applied for a loan of £4,000 for services and mains extensions.

**Harrogate.**—EXTENSION DIFFICULTIES.—The annual accounts of the electricity department show that there is neither a rate charge nor relief. A note of warning was sounded by the chairman of the Electricity Committee, who said that applications to borrow for the installation of a boiler for the electricity undertaking, and extensions at the works for the installation of a Diesel engine, involving a sum of £11,000, had been made, and there would be difficulty in finding the money.

**Haslingden.**—MAXIMUM INSTALLATION COST.—The Town Council, on June 24th, decided that the maximum cost to be incurred for installing services for domestic and small power consumers should not exceed £5. It was agreed to enter into no further contracts for the supply of electricity for a term of years, and notice was given to terminate the agreement with Messrs. Nobell's, Ltd.

**Ipswich.**—YEAR'S WORKING.—The total income of the electricity undertaking for the past year was £75,311, and the net profit £8,443. After deducting part of the previous year's deficit, and debiting the cost of work on mains, a balance of £5,838 was placed to reserve.

**Lanark.**—ELECTRIC LIGHTING SCHEME.—The Town Council has engaged Mr. J. M. M. Munro, of Edinburgh, at a fee of 50 guineas, to report on an electric light scheme for the town, either by water power or by a thermic station.

**Leeds.**—YEAR'S WORKING—CORRECTION.—By an error in our last issue (June 25th, p. 816), the gross profit of the Leeds electricity undertaking was given as the revenue. The correct figures are as follows (the previous year's equivalents being given in parentheses):—Total income, £468,718 (£327,176); total working expenses, £237,823 (£186,700); gross profit, £230,895 (£140,476); taxes, loan charges, &c., £130,478 (£133,610); net profit, £100,417 (£6,866); contributions to capital expenditure, £56,008 (£6,217); leaving a surplus of £44,409 (£649).

**Liverpool.**—NEW SUB-STATION.—The city electrical engineer has been authorised to erect a sub-station at the Hatton Garden premises.

**London.**—STEPNEY.—As a result of the successful suit brought against the Corporation for compensation in respect of damage and inconvenience caused by ashes and grit from the Council's power station, and the injunction granted by the Court to restrain the Council from causing future nuisances of this nature (ELECTRICAL REVIEW, June 18th, 1920, p. 778), the Electricity Committee has appointed a deputation to interview the Electricity Commissioners on the question, and experiments are to be carried out with preventive devices in order to remove the cause of the trouble, and comply with the ruling of the Court.

ST. PANCRAS.—The borough electrical engineer has formulated a scheme for supplying electricity to small dwellings. The estimated cost of a six-point lighting installation is £10 10s., and this with the interest on the outlay will be repaid by the consumer in quarterly instalments. Lighting will be charged for on a fixed price basis, and the estimated quarterly cost to the consumer, including repayment of outlay, is £1 17s. 5d. for a three-years' period, or £1 3s. for a period of 10 years, after which the only charge would be that for the electricity consumed—14s. 5d.

**Mexborough.**—NEW GENERATOR.—The Council has approved, subject to the sanction of the Electricity Commissioners, the purchase of a 1,000-KW. turbo-generator, at an estimated cost of £13,170.

**Middleton.**—ELECTRIC LIGHTING SCHEME.—The Council is considering the institution of electric lighting in the town.

**Montgomery.**—LIGHTING.—There is some doubt as to what lighting facilities will be available next season, and a feeling exists amongst members of the Council that if there is any undue delay in announcing the arrangements of the lighting authority, the Council should launch an electric lighting scheme.

**Nuneaton.**—YEAR'S WORKING.—By an error the financial result of the past year's working of the electricity undertaking was stated to be a surplus of £900. It is now announced that the correct result was a deficit of £49.

**Ormskirk.**—TIME EXTENSION.—The Board of Trade has extended by one year from June 24th, 1920, the time for compulsory purchase of lands under the Ormskirk Gas and Electricity Act, 1915.

**Wingate (County Durham).**—EXTENSIONS.—The Parish Council has decided to extend the electric lighting installation to the adjoining centres of Trimdon and Thornley.

# TRAMWAY AND RAILWAY NOTES.

**Blackburn.**—Year's Working.—The traffic receipts for 1919-20 amounted to £117,413, and revenue from the carriage of parcels, £2,545; working expenses totalled £91,911; and the net result, after payment of loan interest, &c., was a profit of £413, compared with a balance of £6,650 for the previous period.

**Bradford.**—Railless Car.—The Tramways Committee has received sanction to proceed with the building of an experimental double-deck, railless trolley car, designed by Mr. R. H. Wilkinson (general manager). The car will have an enclosed upper deck, and the total seating accommodation will be for 51 passengers. The car, which is under construction at the Bradford tramways' workshop, is the first of its kind in the country. It will be driven by one standard tramcar motor, mounted on a solid tramway axle. Mr. Wilkinson holds that improvement has been chiefly handicapped by restriction of weight, which has hitherto been limited to 5 tons loaded, and by uncertainty of the amount that should be contributed to road maintenance. Mr. Wilkinson has prepared a comparative estimate of the cost of construction of railless and tramway cars on a new route, indicating up to what density of traffic the railless vehicle is the more economical. The present railless services are working at 4d. per mile less than ordinary cars, and by increasing the seating capacity from 29 to 51, and using the cars on busier routes, and over the ordinary car gradients of the city rather than the existing favourable level routes, the working expenses and sinking fund charges would probably be about equal to those of the ordinary type. Even if the charges were 2d. per mile greater than those of the ordinary tramcar—meaning 6d. per mile, as compared with the present railless car-service costs—the railless system would be more economical. Mr. Wilkinson has considered the comparative advantages and disadvantages of track and railless cars with regard to passengers' comfort, liability to accidents, especially on steep gradients, and general reliability. He agrees that railless cars are less comfortable than tramcars if the permanent way is in good condition; that railless cars are liable to skid in snow; and, being without track, are more liable to collisions in fog. They make less noise than tramcars, and can draw closer to the side of the road for convenience of loading and unloading. A point also to the advantage of railless cars in the parcel service is that by the adoption of batteries they may run beyond the range of the trolley wires, as has been done between Bradford and Leeds for nearly a year past.

**Brighton.**—High-Speed Railway.—The Corporation has offered no objection to the construction of an experimental high-speed railway, running between Brighton and Newhaven and Rottingdean. This is to pass over an estate owned by the Corporation.

**Continental.**—Spain.—H.M. Consul at Vigo (Mr. Thomas Guyatt) calls attention to the new project for extending the Vigo electric tramways as far as Redondela—an extension of 8 km. United Kingdom firms which may be interested in the matter from the point of view of supplying materials may obtain the name and address of an official in Vigo on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1.

**Cork.**—Boycott of Military.—It is reported that the men in charge of the cars of the Cork Electric Tramways Co. have joined the movement—inaugurated by certain Irish railwaymen—for refusing to carry military and police bearing arms. The movement is part of the Irish Labour protest against the importation and handling of munitions.

**Croydon.**—Year's Working.—The total revenue, including bank interest, &c., for the year ended March 31st, 1920, was £163,037, as compared with £136,443 for the previous period. The total expenditure, including income-tax, loan interest, &c., amounted to £180,290, as against £123,889, leaving a net deficit of £17,253, compared with a surplus of £12,554 for 1918-19.

**Darlington.**—Extension Deferred.—The proposal to lay a track between the Market Place and Bank Top station at an estimated cost of £15,000, has been deferred.

**Dundalk.**—Price of Supply.—The Urban Council, having considered the Great Northern Railway (Ireland) Co.'s offer of 1·6d. per unit for electricity supplied during the year ended December, 1919, decided that the offer was inadequate, and that the minimum offer which the Council could accept was 1·9d. per unit.

**Glasgow.**—Year's Working.—The financial statement of the tramway undertaking for the year ended May 31st shows a total income of £1,721,578—last year's figure was £1,531,320. The total working expenses amounted to £1,558,161, as against £1,249,989, leaving a gross balance of £163,417, as against £281,331. The addition of interest on investments gave a total profit of £176,762, compared with £291,896 for 1917-18. The payment of rents, interest, income-tax, &c., resulted in a net deficit of £108,531, compared with a profit of £14,773 for the previous year.

**Halifax.**—Advertisements on Cars.—The Tramways Committee proposes to discontinue advertising on the cars. The advertisements yield about £1,000 per year, and the recommendation is expected to meet with the opposition of the Town Council.

Extensions Inquiry.—The consideration of new tramway proposals of the Halifax Corporation occupied the whole of June 25th before a Select Committee of the House of Lords, presided over by Lord Newton. The proposals included a new tramway running from the Halifax main tramway line at Satterhebble and proceeding through Elland to join the existing Huddersfield lines near the Elland Town Hall. There was great opposition, Huddersfield Corporation objecting on the ground of competition, and the West Riding County Council, which demanded various road widenings along this route and upon others.—*Sheffield Daily Telegraph.*

**Ilford.**—Fare Revision.—The tramway manager reports that further increases of fares are necessary in view of running costs.

Painters in the tramway department are to be paid £5 5s. 9d. per week.

**Leeds.**—Loss on Working.—A return issued recently showed that during the first nine weeks of the current financial year to June 2nd, when the fares were advanced, the revenue was £159,746, but the gross expenditure was £176,023, leaving a deficit on the period of £16,277, or £258 per day, despite the fact that the revenue had increased by £6,843 on that of the corresponding period of the previous year. Since the fares were increased, it is reported, the total number of passengers carried has increased by 1 per cent., chiefly in the new short-distance penny fares; the other fares have shown a decrease.

The Minister of Transport has extended the time until August 7th, 1921, of the Leeds Corporation Act, 1914, for the completion of Tramway No. 2.

**Manchester.**—Revised Fares.—Revised tramway fares on several routes came into force on June 20th, 27th, and onwards. After a long interval, workpeople's tickets have again been introduced, the fares being the same as the old ordinary fares before the revision. Any passenger travelling by car before seven o'clock in the morning may take a special privilege ticket for the double journey at workmen's rates. The return journey may be made at any time the same day. The ticket is cancelled on the return journey by the conductor, who will issue an ordinary ticket in its place. These workmen's tickets will be available on each route as the revised fares come into force.—*Manchester Guardian.*

Employes' Wages.—Although they received an advance of 9s. per week as a result of arbitration proceedings since their strike at Easter, Manchester tramwaymen are still dissatisfied, and have decided to send in a new demand for an increase of £1 per week, with a threat to strike if the demand is not met.

**Middlesex.**—Tramway Fares.—At a meeting of the Middlesex County Council a protest was made against the recent increases in fares on the Metropolitan Electric Tramways. An interim order has been granted to the tramway company by the Ministry of Transport. Mr. Martin Read said that the Council was a partner with the tramway company, which had no legal or moral right to make application for an increase in fares to an outside authority without the Council's consent. The Highways Committee's recommendation to support the company's application to the Ministry of Transport for the issue of an interim order authorising an increase of fares was withdrawn.—*The Times.*

**N.E.R.**—New Branch.—A new branch of the N.E.R near Stockton-on-Tees, and known as the Billingham Beck branch was opened on June 21st. It is worked under the train-recording telegraph regulations where the rails are a double set, and the electric train tablet system of signalling for the portion where a single line of rails will carry the traffic. At present the new branch is only to be used for freight traffic.

**Portsmouth.**—Result of Fare Increase.—An illustration of the fact that there is a point beyond which fare increases are impracticable, is given by the result of increased fares at Portsmouth. During eight weeks the passenger traffic has fallen off by 1,500,000, causing a loss of over £6,000.

**U.S.A.**—Storage-Battery Car.—The *Railway Review* gives details of an electric storage-battery car, manufactured by the Railway Storage-Battery Car Co., New York, which will be operated in daily service between Atlantic City and Ocean City, N.J., 18 miles distant. The car will be run on a regular schedule, making both forenoon and afternoon trips, a total of 72 miles each day, which will give railroad officials concerned in the maintenance of isolated passenger traffic an excellent opportunity to observe its performance under actual operating conditions. The car weighs 30 tons without load. Its maximum free running speed on level tangent track is 45 miles per hour. Motive power is derived from a bank of 240 Edison-type A-12 alkaline storage cells, which, on a single charge, are capable of propelling the car a distance of 125 miles. By boosting the charges nominally, while waiting for an exchange of passengers at terminals, this mileage can be increased to 175. The journals of each of the four axles run in frictionless bearings, each pair of wheels being propelled by means of its own motor transmitting power through a single reduction spur gear. The average energy consumption per car-mile is 2¼ kw.-hours, measured on the basis of input at the charging station. In addition to the battery equipment mentioned, eight additional cells are installed for the benefit of lighting circuits. Ampere-hour meters are provided to ensure the proper charging of the batteries. The car is 52 ft. 2 in. in length over vestibules, and will seat 50 passengers.

## TELEGRAPH AND TELEPHONE NOTES.

**Cable Delays.**—Though the efforts made by commercial interests to effect an improvement in the London-Paris and London-Amsterdam telegraph service have so far proved of little avail, it seems timely to draw attention once more to the delays which are still experienced. These are of such a protracted nature that it has become the ordinary and daily practice for London Stock Exchange firms to wire Paris *via* New York, and the same device also obtains in the case of Amsterdam. That a much quicker service may be obtained by these means seems hardly credible, but, as a matter of fact, the existing times taken by the two routes are 15 minutes and 1¾ hours respectively.—*The Times.*

**France.**—The exchange of urgent telegrams at triple rates between the United Kingdom and France will be authorised from July, 1920, on the same conditions as exist between those countries in which this system of telegraphic correspondence is already in force.

**Hungary.** — COMMUNICATION INTERRUPTED. — Postal, telegraphic, and telephonic communication with Austria has been severed since June 20th, the only exception being Government and diplomatic messages.—*The Times.*

**Imperial Wireless Chain.**—COMMITTEE'S REPORT.—The Imperial Wireless Committee, of which Sir Henry Norman was chairman, issued its report on Monday. We hope to publish full particulars in later issues; for the present the recommendations are, in brief, that a scheme of Imperial wireless communication be established, connecting the communities of the Empire by geographical steps of 2,000 miles each. It is suggested that the service between Leafield and Cairo, by the Poulsen arc system, shortly to be put into operation by the Post Office, be the first link in the chain of communication with Africa; this should be continued by a station at Nairobi, in East Africa, and by the use of the ex-German station at Windhuk, to complete the connection with the Union of South Africa. For communication with India, the Far East, and Australia, it is proposed that stations be erected in England, at Cairo in Egypt, at Poona or other Indian stations, Singapore, Hong-Kong, and at Port Darwin or Perth in Australia. Similar communication should also be established between England and Canada. The stations, it is proposed, should be planned by a wireless commission of about four members, while their construction might be entrusted to the engineering department of the G.P.O. and the corresponding Dominion and Indian authorities. The estimates of revenue and expenditure indicate an initial annual loss of about £100,000, divided between the Imperial and other Governments concerned; this loss, however, might reasonably be regarded as likely to decrease until after 10 years a profit would be shown. The capital cost of the scheme outlined is estimated at £1,243,000, of which £853,000 would be payable by the Imperial Government. The total annual charges are estimated at £425,000, of which £268,000 would fall upon the Imperial Government. The total estimated annual traffic for the whole service would be about 10 million words, producing a revenue of £350,000, of which £205,000 would be receivable by the Imperial Government. The proposals submitted by the Marconi Co. were examined by the Committee, which says that it found them too vague to admit of detailed account. The scope of the scheme was too great, and it would involve too large a capital expenditure and annual expense. The Committee decided that the Marconi scheme would provide a virtual monopoly for that company, which was regarded as undesirable.

**London.**—AUTOMATIC TELEPHONES.—The first step in the task of equipping London with automatic telephones has been decided on by the Post Office. At a City exchange an experiment is to be carried out with the panel selector system of the Western Electric Co., Ltd., of London, and between 3,000 and 4,000 subscribers will be connected.

**Pacific Cable.**—PROPOSED DUPLICATION.—Mr. Bonar Law, in reply to a question in the House of Commons concerning the cable system in the Pacific, stated that various proposals for duplicating the cable between Vancouver and Fanning Island were being considered, but no decision had yet been taken.

**Palestine.**—NEW WIRELESS STATION.—A wireless station to be erected on the Mount of Olives, will, according to *The Times*, be able to communicate with Paris and London.

**Telegraph Rates.**—AUGUST 1ST REVISION.—According to present arrangements, the new rates for inland telegrams of 1d. per word, with a minimum charge of 1s. for 12 words, will come into operation on August 1st next. The necessary Bill, without which the new rates cannot be enforced, will be introduced in Parliament next week by the Postmaster-General.

**United States.**—LARGE WIRELESS STATION. — The Radio Corporation of America has purchased a tract of 6,000 acres at Rocky Point, L.I., about seven miles from Port Jefferson, where it is planned to spend the sum of $10,000,000 in erecting and equipping a new wireless station, which will be the largest in the world. The station will have 72 sets of antennæ radiating from a central station; the steel towers will be 400 ft. high. The station will comprise five operating units—one for communication with Argentina, one with France, one with Scandinavia, one with Germany, and one with Italy and Poland.—*T. and T. Age.*

**Wireless Operators.**—STRIKE ENDED.—At the Seafarers' Joint Council meeting at Liverpool, on June 23rd, an agreement was reached which ended the strike of ships' wireless operators. The men were asked to return to work pending discussions by a Committee with the Marconi Co., the shipowners, and the Board of Trade.

After a conference at the Ministry of Labour, on June 24th, with representatives of the Engineering Employers' Federation, the officials of the Association of Wireless Telegraphists decided that work should be resumed immediately, pending negotiations. The negotiations were opened on June 30th on the basis of the wireless men's original demands. Mr. E. R. Tuck, secretary of the Association, expressed complete satisfaction with the result of the strike, particularly with regard to the full reinstatement of the men who came out.

## CONTRACTS OPEN AND CLOSED.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW, *in which the "Official Notice" appeared.*

### OPEN.

**Australia.**—SYDNEY.—August 4th. N.S.W. Government Railways and Tramways. Two 1,000-KW. sub-station units. Chief Electrical Engineer, 61, Hunter Street, Sydney.

August 3rd. Department of Public Works. Turbines and generators for the Barren Jack hydro-electric development scheme. Department of Public Works, Sydney.

N.S.W.—Postmaster-General's Department. August 2nd and 5th. Aluminium sheet, brass rod, &c., scheduled 769; platinum wire, gold and silver wire, scheduled 768. (June 11th.)

WESTERN AUSTRALIA. — Postmaster-General's Department. August 3rd. 326 accumulators, schedule 668. (June 11th.)

**Belgium.**—August 7th. The municipal authorities of Campenhout (Province of Brabant). Tenders for the establishment of an electrical distribution system in the town. Particulars, for two francs from, and tenders to, the Maison Communale.

**Brentford.**—July 13th. Board of Guardians. Electric lighting installations in the offices, infirmary, &c. (See this issue.)

**Darlington.**—July 16th. Electricity Department. One 5,000-KW. turbo-alternator and surface-condensing plant. (June 25th.)

**Edinburgh.**—July 13th. Corporation. Electric lighting installations of houses at Gorgie. The Town Clerk.

**Grimsby.**—August 12th. Electricity Department. Two water-tube boilers, economisers, fittings, fans, chimneys, &c.; one 3,000-KW. high-pressure turbo-alternator and condensing plant. (See this issue.)

**Glasgow.**—July 6th. Tramways Department. One 10,000-KW. steam turbo-alternator, with condensing plant. (June 18th.)

**Hull.**—July 12th. Electricity Department. One three-motor electrically-operated overhead travelling crane. (June 25th.)

**New Zealand.**—July 31st. Waikato Electric Power Supply. Delivery, c.i.f. Auckland, of 2,400 pin insulators, suitable for a line operating at 66,000 volts between phases. Tenders to Secretary, Public Works Tenders Board, Government Buildings, Wellington. Specification, &c., may be seen at the D.O.T. in London (Captain Vandeleur, Room 49), until to-morrow, Saturday, after which date they will be available for firms in the Provinces.

AUCKLAND.—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London.

**Nuneaton.**—July 31st. Electricity Department. One 500-KW. rotary converter transformer and accessories. (See this issue.)

**Portsmouth.**—July 20th. Tramways Committee. 1,000 tons steel girder tram rails; 20 tons steel fish plates; 5 tons fish bolts; 30 tons wrought-iron tie bars. (See this issue.)

**Preston.** — Tramways Committee. Converting plant. (See this issue.)

**Southampton.** — July 3rd. Electricity Department. E.H.T. and H.T. switchgear and D.C. control panel. (June 4th.)

**Warrington.** — July 13th. Electricity and Tramways Committee. Two 6,000-KW. turbo-alternators. (June 18th.)

### CLOSED.

**Belgium.**—Six concerns, including the Edison-Swan Electric Co., Ltd., London, last week submitted tenders to the Belgian Post and Telegraph authorities in Brussels, for the supply of 1,600-km. of compound telegraph wire. The lowest offer was that of the Société des Ateliers de Constructions Electriques, of Charleroi, who quoted 483,200 fr.

**Dartford.**—Board of Guardians.

Electric light installation, infirm wards—Messrs. Creffield.
Electric laundry irons—S. W. Gibson & Co.

**Glasgow.**—Electricity Committee. Accepted.

For six months :—

C.I. boxes, section pillars, &c.—M'Dowall, Steven & Co., Lion Foundry Co., Carron Co., Falkirk Iron Co., James Allan, Senr. & Co.
Malleable iron tube and fittings.—Dempster, Moore & Co.

For 12 months :—

Ampere-hour meters.—Edison-Swan Electric Co., Ltd., Ferranti, Ltd., Chamberlain & Hookham, Ltd.
A.C. meters.—Edison-Swan Electric Co., Ltd., Met.-Vickers, Ltd.
Cables (general).—Callenders Co., W. T. Glover.
Cables (I.R. flexibles).—Craigpark Electric Cable Co., Ltd.
Arc lamp carbons.—Beacon Carbons, Ltd.

Town Council Tramways. Accepted :—

Cables.—B.I. and Helsby Cables, Ltd.
Gear cases.—Equipment and Engineering Co., Ltd.
Two-ton motor chassis.—Leyland Motors, Ltd.
Lock washers.—Positive Lock Washer Co.

**Government Contracts.**—The undermentioned Government contracts were placed during May, 1920 :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Accumulators for magazine lanterns.—Fuller's United Electric Works, Ltd.
Electrically-driven plate-bending rolls.—Scriven & Co., Ltd.
Electrodes.—Quasi-Arc Co., Ltd.
Micanite insulators.—Micanite & Insulators, Ltd.
Micanite washers.—Birmingham Mica Co.
Micanite plate and tubing.—Mica Manufacturing Co.
Positive plates.—D.P. Battery Co., Ltd.
Carbon rods.—Morgan Crucible Co., Ltd.

MINISTRY OF MUNITIONS.

Electric cell battery boxes.—Fuller's United Electric Co., Ltd.
Conduit tubing.—Metallic Seamless Tube Co.; Simplex Conduits, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Baudot apparatus parts.—Elliott Bros. (London), Ltd.
Tropical cable.—Callender's Cable & Construction Co., Ltd.; Siemens Bros. & Co.
Inert cells.—Fullers United Electric Works, Ltd.
Induction coils.—High Tension Co.
Carsak elements.—General Electric Co., Ltd.
Transposition insulators.—Taylor, Tunnicliffe & Co.
Electric motors (parts).—General Electric Co.
Phonic motors.—D. Murray.
Copper tubes.—T. Bolton & Sons, Ltd.; Allen, Everitt & Sons.
Voltoids.—Brunner, Mond & Co., Ltd.
Copper wire.—Callender's Cable & Construction Co., Ltd.; Macintosh Cable Co., Ltd.
Iron wire.—Shropshire Iron Co.
Jumper wire.—Peel-Conner Telephone Works Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; International Electric Co., Ltd.; Western Electric Co., Ltd.
Testing and protective apparatus.—Phœnix Telephone & Electric Works Co.; Reid Bros. Engineers, Ltd.
Armatures.—British L.M. Ericsson Manufacturing Co., Ltd.
Battery boxes.—Wm. Duncan Tucker & Sons, Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Macintosh Cable Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Compound.—Dussek Bros. & Co., Ltd.
Cords for telephones.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fire Brick Co., Ltd.; Doulton & Co., Ltd.; J. Oakes & Co.
Distribution cable plugs.—Siemens Bros. & Co., Ltd.
Solder.—E. Austin & Sons; British I. & H. Cables, Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.
Copper binding wire.—British I. & H. Cables, Ltd.
Enamelled and cotton-covered wire.—Fuller's United Electric Works, Ltd.; Macintosh Cable Co., Ltd.
Transmission and receiving sets.—Devizes Wireless Station: Marconi Wireless Telegraph Co., Ltd.
Laying conduits.—St. Pancras, Finsbury, Shoreditch and Holborn: D. R. Paterson, Ltd. Chelsea (Beaufort Street), Old Broad Street, Threadneedle Street, Westminster, Chelsea and Epsom: J. Mowlem & Co., Ltd. Belfast, London-Bristol-Newport (S. Midland, Section IV): J. F. Hodge & Co. London-Bristol-Newport (S. Wales, Section I): D. Kettle & Son Camberwell, &c., Kensington, Paddington, St. Marylebone, Willesden, Wembley, &c., Hornsey-Islington: O. C. Summers. Streatham-Tooting: Whittaker-Ellis. Leeds-Harrogate (Section II): Hodge Bros. (Contractors), Ltd. Douglas (Glasgow): W. Dobson. Fulham, Battersea, Wandsworth, Merton, Hammersmith, &c.: Laing & Co.
Manufacturing, supplying and drawing-in and jointing cable.—London-Slough: Western Electric Co., Ltd.
Repairing battery.—City (London) Telephone Exchange: Hart Accumulator Co., Ltd.
Telephone Exchange equipment.—Fleetwood: Relay Automatic Telegraph Exchange, Ltd. Accumulators: Hart Accumulator Co., Ltd. Motor generator set: Electromotors. Ltd. Wallasey: Western Electric Co., Ltd. Accumulators: Chloride Electrical Storage Co., Ltd. Motor generator sets: Electric Construction Co. Paddington: Western Electric Co., Ltd. Stroud: Siemens Bros. & Co., Ltd. Accumulators: Hart Accumulator Co., Ltd. Charging machine with motor: English Electric Co., Ltd. Eccles: Siemens Bros. & Co., Ltd. Accumulators: Pritchett & Gold & E.P.S. Co., Ltd. Charging machine: English Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—Callender's Cable & Construction Co., Ltd.
Tonum cells.—Chloride Electrical Storage Co., Ltd.
Electric light fittings.—J. Stone & Co., Ltd.
Diesel engine spares.—English Electric Co., Ltd.
Phosphor bronze and white metal.—Phosphor Bronze Co., Ltd.
Telegraph poles.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Telegraph line material.—Siemens Bros. & Co., Ltd.
Telephone material.—British L.M. Ericsson Manufacturing Co., Ltd.
Static transformer.—British Electric Transformer Co., Ltd.
Bronze wire, &c.—Shropshire Iron Co., Ltd.
Copper wire.—Elliott's Metal Co., Ltd.

**London.**—L.C.C. Highways Committee. Recommended :

5,500 tons of track rails and fastenings, for the tramways department, £154,747—Bolckow, Vaughan & Co., Ltd.

ST. PANCRAS.—Electricity Committee. Coal for 12 months, for the electricity stations. J. H. Beattie recommended :—

| | | New contract. | 1919-20 contract prices. |
|---|---|---|---|
| | | s. d. | s. d. |
| 14,400 tons | Newdegate beans | 43 10 | 31 2 |
| 6,400 ,, | Newdegate D.S. nuts | 45 1 | 32 5 |
| 2,400 ,, | Griff peas | 45 7 | 32 11 |
| 1,200 ,, | Coleorton D.S. nuts | 44 10 | 32 2 |
| 500 ,, | Mapperley small nuts | 46 7 | 33 11 |
| 10,900 ,, | Stanton nutty | 43 7 | 30 11 |
| 35,900 ,, | for King's Road | | |
| 7,100 ,, | Haunchwood steaming | 45 10 | 33 2 |
| 3,000 ,, | Ramcroft hards | 48 6 | 30 10 |
| 10,100 ,, | for Regent's Park | | |

STEPNEY.—Electricity Supply Committee. The Committee has accepted the following offers for coal :—

5,200 Bolsover 1¼ nutty slack, 42s. 1d. per ton; 2,400 tons Snibston 1¼ nutty slack, 41s. 2d. .. .. E. Foster & Co.

Earthenware pipes.

**Sutton & Co.** (accepted) .. .. .. .. .. **£82**
Doulton & Co., Ltd. .. .. .. .. .. .. 82
W. T. Henley's Teleg. Works Co., Ltd. .. .. .. 96

Cable 110 yds. '5 sq. in. L.T. cable, and 440 yds. '05 sq. in. L.T. cable.

**W. T. Henley's Teleg. Works Co., Ltd.** (accepted) .. **£467**
B.I. and Helsby Cables, Ltd. .. .. .. .. .. 474

1½ miles '025 sq. in. L.T. cable, and ½ mile '007 sq. in. L.T. cable.

**W. T. Henley's Teleg. Works Co., Ltd.** (accepted) .. **£860**
B.I. and Helsby Cables, Ltd. .. .. .. .. 873

HAMMERSMITH.—Electricity Committee.

(*a*) TENDERS FOR ONE 10,000-KW. TURBO-ALTERNATOR, WITH CONDENSING PLANT.

| | Gen. plant. | Con. plant. | Total. | Steam con. per KW.-hr. | Delivery months. |
|---|---|---|---|---|---|
| C. A. Parsons & Co., Ltd. .. | £41,100 | £12,500 | £53,600 | 12·15 | 14 |
| J. Howden & Co., Ltd. | 40,750 | 13,369 | 54,119 | 12·9 | 13 |
| | 50,432 | 13,369 | 61,801 | 12·83 | 14 |
| Fraser & Chalmers' Engineering Co., Ltd. | 40,960 | — | 54,329 | 12·52 | 14 |
| | 43,260 | — | 56,629 | 12·04 | 16 |
| Escher, Wyss & Co., Ltd. .. | — | — | 56,225 | 11·97 | 11* |
| B.T.H. Co. Ltd. .. .. | 42,000 | — | 55,369 | 12·55 | 18 |
| Met.-Vickers Elect. Co., Ltd. | — | — | 57,600 | — | 15 |
| | — | — | 61,800 | — | 15 |
| | — | — | 64,300 | — | 15 |
| Ateliers de Con. Oerlikon .. | — | — | 58,348 | — | 17 |
| English Electric Co., Ltd. .. | — | — | 58,700 | — | — |
| Richardsons, Westgarth and Co., Ltd. | — | — | 61,180 | — | — |

*At works in Switzerland.

TENDERS FOR ONE CONDENSING PLANT.

| Name of tenderer. | Single type. | Twin type. | Cooling surface sq. ft. | Water required, lbs. per hour. | |
|---|---|---|---|---|---|
| Mirrlees, Watson Co., Ltd. | £13,369 | £14,100 | 13,000 | 7,800,000 | Extra for sluice valves. |
| C. A. Parsons & Co., Ltd. | 12,500 | — | 12,500 | 7,050,000 | — |
| Hick, Hargreaves and Co., Ltd. | — | 14,952 | 14,700 | 7,150,000 | 8 sluice valves included. |
| Worthington-Simpson, Ltd. | 15,748 | 16,600 | — | — | — |
| W. H. Allen, Sons and Co., Ltd. | 16,376 | — | 15,500 | 8,130,000 | — |
| Cole, Marchent and Morley, Ltd. | 16,832 | 17,112 | 16,000 | — | — |

The Committee reports that in connection with the scheme for plant extensions passed by the Council on March 24th, embodying the installation of two 10,000-KW. turbo-alternators with condensing plant, the lowest tender received for two satisfactory sets exceeded the estimates by approximately £14,000. In these circumstances, and in view of the present high loan interest, the Committee recommends that an order should be placed for one complete generating set only for the time being. This will be possible in view of the purchase from the Liverpool Corporation of one 2,000-KW. set, the Liverpool Corporation having accepted this Council's offer.

The Committee considers that Messrs. C. A. Parsons's tender at £41,000 for one 10,000-KW. turbo-alternator is the most suitable, and recommends its acceptance.

As regards the condenser, the electrical engineer considers the offer of Messrs. Hick, Hargreaves & Co. the most satisfactory. The water required for this condenser is less than that in the case of other twin types of machines, and the price includes an allowance estimated at £400 for sluice valves. The Committee, therefore, recommends the acceptance of the tender of Messrs. Hick, Hargreaves & Co. for one twin type condensing plant at £14,952.

**Ryde.**—Isle of Wight E.L. Co. For the electric light installation at the Congregational Church.

**Stirling.**—Town Council :—

Electric light installation for houses.—W. and F. Marshall, and Lockhart and McNab.

## FORTHCOMING EVENTS.

**Tramways and Light Railways Association.**—Friday, July 2nd. At Caxton Hall, Westminster, S.W. At 2.30 p.m. Annual congress. At 7.30 p.m. at the Connaught Rooms: Annual dinner.

**Royal Institution of Great Britain.**—Monday, July 5th. At Albemarle Street, W. At 5 p.m. General meeting.

**Institution of Civil Engineers.**—Tuesday, July 6th. At the Institution, Gt. George Street, S.W. Conversazione from 8.30 p.m. to 11 p.m.

## NOTES.

**Turbines at Kinlochleven.**—Referring to our article on the visit of the Institution of Electrical Engineers to the British Aluminium Co.'s works at Kinlochleven, Mr. James Gordon informs us that the latest addition to the plant, a 3,000-H.P. turbine, was not, as stated, supplied by Messrs. Gilbert Gilkes, but by his own firm, Messrs. James Gordon & Co. We very much regret the error.

**National Illumination Committee of Great Britain.**—At a meeting held on June 21st, the Committee accepted with regret the resignation of the chairman, Mr. A. P. Trotter, and Major Kenelm Edgcumbe (vice-chairman) accepted the vacant post. Dr. F. P. Hyde, delegate from the American National Committee, attended to discuss the future policy of the International Commission, and to explain the views of various Continental Committees he had met. It was unanimously agreed that a meeting of the International Illumination Commission should be held in Paris next year to discuss technical subjects.

**Classification of Large Turbo-generator Failures.**—In a paper presented at the A.I.E.E. annual Convention, last month, and abstracted in the June *Journal* of the Institution, Mr. Philip Torchio classifies 55 generator failures of which he has a record. The machines, installed in different parts of the U.S.A., range in capacity from 5,000 to 30,000 KW., the smaller size dating back from 12 to 16 years, and the larger being of more recent manufacture. The failures, several occurring on the same set, are summarised as follows:—

*Armature failure* due to: mechanical damage, 3; heating of windings, 17; heating of iron, 2; loose laminations, 1; moisture in cooling air, 3; corona shield breaking, 2; heating at end-turn clamping, 1; undiscovered causes, 2; total, 33.

*Field failure* due to: open-circuited connections, 3; earthing, 7; earthing caused by bus short circuit, 4; loosening of damper windings, 2; total, 16.

*Armature and field failures* due to: moisture, 1; undiscovered, 3; total, 4.

*Terminal failures* due to moisture, 2.

To avoid similar troubles, the author advocates the use of insulating materials of proved dependability, maintenance of low copper temperatures by proper sub-division of copper and transposition of strands in windings, and the provision of liberal ventilation. The operating copper temperatures should be limited to 100° C.; too great a range of operating temperatures is bound to cause failure. Mica insulation in hydro-electric generators operated at steady load will last indefinitely at high temperatures, while, under similar conditions, mica insulation in steam turbo-generators operated intermittently will fail. The test voltage for windings should be raised to three times full voltage, plus 1,000. Mica and asbestos tape insulation for fields is more dependable than fibrous insulation. Solid forged fields are preferable to laminated field structures, or even to built-up plate structures. Great care should be exercised in the supply of cooling air to prevent moisture or condensation depositing on the windings.

**Post Office Tube Railway.**—Tenders have been invited for the equipment of the Post Office tube railway, the initial section of which is 6·5 miles long, extending between the eastern and western termini at Whitechapel and Paddington respectively. There is only one tunnel between stations; it is 9 ft. in diameter and contains two 2-ft. gauge tracks. Separate tunnels ranging up to a maximum of 25 ft. in diameter have been constructed at the stations. Both lines are on the same level, and are 20 ft. apart; on this space, control cabins, together with lifts and shoots for handling mail matter, are being installed. The depth of the tube from the surface varies from 28 ft. to 87 ft. It is proposed to operate the trains on the distant control system; current excitation on the track will take the place of the signal element, thus dispensing with the need of an attendant on the cars. According to the *Engineer*, the details of the system were worked out by the Post Office engineering staff at Woolwich, where both the gradients and curves of the actual railway were reproduced. Firms invited to tender received an intimation that any suggested improvements in the proposed method of operation or an alternative system would receive consideration.

**Appointments Vacant.**—Resident engineer (£400) for Cambuslang Electricity and Refuse Destructor Works; lecturer in Electrical Engineering (£350 to £400) for the Technical College, Loughborough; lecturer in Electrical Engineering and Wiremen's Work (£300) for the Barnsley Educational Committee; deputy charge engineer (£334) for the Newcastle-upon-Tyne Electric Supply Co., Ltd.; shift engineer (£334) for the Ipswich Corporation Electric Supply and Tramways; shift engineer, for the Perth Corporation Electricity Works. See our advertisement pages to-day.

**British Water Power.**—The Water Power Resources Committee has recently issued a second interim report which, *inter alia*, recommends the establishment of a Water Commission for England and Wales, possessing a number of statutory powers. These include the administration of a special fund for the commencement of enterprises in sparsely populated districts with an abundance of water power; the compilation of records concerning water power with regard to future developments; the adjustment of disputes connected with allocations of water power; to consider the development of rivers, and to group the country into suitable areas controlled by Water Boards.

**Pictures by Wireless.**—A Dane, Mr. Th. Andersen, has made an important invention by means of which pictures and sketches can be transmitted by cable and also by wireless over the longest distances, as, for instance, from Europe to America. The invention has been tested here by experts, who pronounce it to be of great practical value, especially for Press illustrations. The apparatus used is of the most simple construction and easy to work. It does not matter whether the telegraphic communication is interrupted some part of the time. The system includes some special signals, which can be dispatched without being affected by variations in the power of the current employed. Any wireless telegraph or telephone system can be used for the transmission, and the cost of working is said to be very low. One of the Copenhagen newspapers has published two photographs sent by means of the new invention, one of them being a portrait of Chancellor Bauer, dispatched from Berlin.—*Daily Telegraph.*

**Development of Electricity in South Africa.**—In a papar entitled "The Use of Electricity to Develop South African Resources," read before the S.A. Institute of Electrical Engineers, Mr. H. W. Clayden, according to the *S.A. Engineer and Electrical Review*, suggested that to secure the greatest benefit of electricity for the development of the resources of the country, the Institute should recommend the Government to go one step further than the recent Railway Electrification Report, and request it to obtain a report on the feasibility and cost of a national power supply scheme to cover the whole of the Southern States of South Africa at present served by railways, allowing for extension of the scheme as a more forward policy of railway extension is adopted; also, in the interest of the conservation of the country's material resources, should the scheme go forward to pass a power Act making it compulsory to obtain power from that supply, by putting a premium on the coal used by small inefficient steam power plant.

**An Electrically-Propelled Yacht.**—Mr. Pemberton Billing, M.P., is, according to the *Evening News*, having a twin-screw schooner of about 44 tons built for him at Southampton. She is to be electrically propelled, and will thus be the first British yacht to be driven in this manner. Each propeller will be driven by a separate motor, the energy for which will be supplied by three generators driven by paraffin engines.

**New Vulcanising Process.**—An entirely new process for effecting vulcanisation has recently become available as the result of the discovery, by Mr. S. J. Peachey, lecturer in chemistry at the Manchester College of Technology, that by exposing rubber alternately to the action of two gases, viz., sulphur dioxide and hydrogen sulphide, it becomes rapidly and completely vulcanised, even at the ordinary temperature. The process appears to be of fundamental importance for the following reasons:—

1. It is a true sulphur vulcanisation (as distinct from the sulphide chloride treatment) and yields a product entirely comparable with that obtained by the Goodyear process.

2. It eliminates the use of heat, and to a great extent the use of mechanical pressure.

3. It employs two gases, both of which can be produced on the large scale at a very cheap rate.

4. It is rapid in action.

5. It enables the manufacturer to employ organic filling agents such as leather waste, sawdust, shoddy waste, and the like, which cannot be used in connection with the hot process. In this manner a number of cheap and highly-durable materials may be fabricated from the various wastes, and employed as floor and wall coverings, for boot and shoe manufacture, and for upholstery work.

6. Coal tar dyestuffs and even natural dyes, which, with a few exceptions, are destroyed by the "hot cure," can be introduced into mixings to be cured by the new process with the production of delicate tints and shades hitherto unobtainable.

The process has the advantage of extreme simplicity, and its translation from the laboratory to the works should prove a very simple matter.

Already numerous samples of daintily coloured floor coverings, fancy leathers, and felts, suitable for hat making, have been produced in the laboratory, and these have an appearance and a finish which could hardly be improved upon. Several pairs of boots have been soled with leather reformed from waste by the new process, and the practical test of several months' hard wear has shown that the reformed leather is even more durable than the real article.

The process can be extended to the vulcanisation of rubber in solution. If a solution of rubber in benzole or naphtha be saturated or partly saturated with hydrogen sulphide and mixed with a solution of sulphur dioxide in the same solvent, the liquid sets in a few moments to a stiff jelly, and on eliminating the solvent by evaporation a fully vulcanised rubber is obtained. The use of the mixed solutions for producing perfectly vulcanised seams and joints has proved highly satisfactory in practice, and inner tubes repaired in a few moments by the new process have an excellent life. Further, by the aid of the solution process, reformed leather soles and heels may be attached to boots without the aid of stitching or nailing, and indeed a boot may be produced from the reformed leather without a single stitch being necessary.

**Service Notes.**—Recruiting for the wireless branch of the service is being pushed to the best advantage, and some exceptionally good men have been obtained, the bounty being a big factor in the matter. The following warrant electricians have been posted to ships:—F. R. Darely to the battleship *Valiant*, Atlantic Fleet; J. Haigh to the staff of the *Vernon*, torpedo school ship at Portsmouth; W. Beavis, to the *President*, London.

An Admiralty order states that officers appointed to the following wireless telegraph stations will be appointed normally for a period of one year:—Aden, Bathurst, Bermuda, Ceylon, Demerara, Falkland Islands, Jamaica, Mauritius, Port Nelloth, Seycielles, Singapore. Officers appointed to the following stations will be appointed normally for a period of two years:—Ascension, Durban, Gibraltar (North Front and Rock), Hong Kong, Malta (Rinella and St. Angelo), St. John's. Officers appointed to stations coming under either category will be allowed the option of an extension of their appointments up to a maximum of three years. A list of officers requiring relief should be sent in by the stations concerned, so as to arrive in England two months before the date they are due for relief, this date being stated.

It should be noted, the order further states, that an appointment of two years' duration coming within the terms of Article 1526, K.R., and A.I., or included in the lists subjoined to M.O.'s 378/19 and 690/20, entitles the holder to repayment of half cost of passage for his wife and family, but that the privileges of free passages for wives and families is restricted by the provision of Article 1526 K.R. and A.I., to officers holding appointments, the duration of which is five years or upwards.

**The "Steinmetz" Electric Vehicle.** — Particulars are now to hand of a new electric vehicle motor system developed by Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Co., of America. Dr. Steinmetz has organised a company under the title of the Steinmetz Motor Car Co., New York City, which plans to manufacture electric commercial and industrial vehicles embodying this system and other interesting features.

By his method of motor excitation, Dr. Steinmetz claims, says the *Electric Vehicle*, that he is enabled to combine the advantages of the series and shunt motor for vehicle propulsion to a certain extent. The system consists merely in connecting a single storage cell across the field winding of a series wound motor, floating the cell on the line. With the battery voltage and the field winding employed, the voltage drop in the field winding at about normal load is equal to the voltage of the field storage cell, and, as the two voltages then balance each other, no current will flow through the cell.

No matter how the load on the motor may fluctuate, the field strength, it is asserted, varies only within relatively narrow limits, the minimum field excitation being that due to the storage cell alone. If the car runs down a grade under the influence of gravity, its speed will increase until the counter electromotive force generated in the motor armature exceeds the electromotive force of the vehicle battery. Then the motor, acting as a generator, will charge the battery, thus recuperating some of the extra energy spent in ascending the hill.

The experimental work has been done mainly on a ½-ton delivery vehicle built in Chicago. The chassis with battery, but without body, weighs about 2,300 lb. It carries a 20-cell, 250 ampere-hour lead storage battery of the Exide type, and has an average mileage under normal road conditions of 45 to 50 miles.

Dr. Steinmetz makes use of a motor having a revolving field ring. The advantage claimed for this type of motor is that substantially twice the output can be obtained from a motor of given weight and absolute speed of members, as compared with the ordinary motor with stationary field. The motor is otherwise of conventional design.

The motor is arranged with its shaft at right angles to the rear axle; to the forward side of the pressed-steel axle housing is bolted a cast steel housing enclosing the reduction gears. The armature is geared to one axle shaft through a pair of spur gears and a pair of bevel gears, and the field frame to the other. No differential gear is required, as the torque on both field and armature naturally is always the same; consequently the same driving torque is impressed on the two road wheels. At the front of the transmission case is the motor, supported in bearings in a spider covered with sheet aluminium. The motor housing is spring-suspended at its forward end from the frame, and the motor and gear, therefore, are not absolute dead weight on the axle. There is a partition wall between the gear case and the motor housing, so the gears can be run in oil without danger of oil getting into the motor; annular ball bearings are used on the shafts.

The speed control is effected by connecting the battery cells either all in series or in two parallel rows respectively, and by cutting a resistance in and out with each battery combination. Thus four speeds are obtained: (1) Battery in parallel, resistance in; (2) battery in parallel, resistance out; (3) battery in series, resistance in; and (4) battery in series, resistance out.

On half voltage or with the controller lever in the low speed position, the battery begins to recharge at a vehicle speed of 10-11 M.P.H., and on full voltage it begins to recuperate at 19 to 20 M.P.H. The advantages resulting from the comparatively flat motor characteristic and the recuperating action are summarised by Dr. Steinmetz as follows:—

(1) The speed is well maintained on heavy up grades and with heavy loads. (2) A quicker and less sluggish getaway at starting. (3) On level and slight down grades, the maximum speed is limited, so that a careless driver cannot race the vehicle. (4) On down grades (and in stopping) the motor automatically becomes a generator, acts as a brake, and feeds the battery. Therefore the vehicle is perfectly safe when on heavy down grades, as the motor checks the speed and holds it down to a safe limit. Incidentally this saves wear of the brakes, as they never need be used except to come to a dead stop. This results in a better maintenance of the vehicle mileage in hilly territory. (5) Much of the power wasted in the motor field at large currents is saved, thus increasing the mileage.

The Steinmetz Motor Car Co. contemplates an output of 1,500 industrial electric vehicles and 500 electric delivery wagons of 1,000 lb. and 2,000 lb. respectively during the first year of its operations. Later other sizes may be manufactured. The construction will be as nearly standard as possible, only the motor and control being of special design.

**Irish Coal Mines.** — It has been left to the energy enterprise, and resource—and incidentally the capital—of Mr. Samuel Kelly, a well-known Belfast coal merchant, to seriously tackle the problem of the Tyrone coalfield, which has its centre at the village of Coalisland. The report just made by the Irish Coal Industry Committee, whilst recording the above fact, expresses most emphatically the unanimous opinion that the State should do something to develop the resources of the country, and towards this end the Minister of Transport should be constituted a Minister of Mines, or a Department of Mines created within the Department of Agricultural and Technical Instruction. Some 18 months ago borings were started at Washing Bay, on the shores of Lough Neagh, under Government direction, but were abandoned at a depth of 1,706 ft. without reaching the carboniferous strata. £15,000 was expended on these operations, and the Committee now recommends that a further £5,250 be spent in sinking these borings to a depth of 3,700 ft., in order to reach the coal—for it is a practical certainty that there is coal to be found. Mr. Kelly is making two borings in another part of the Coalisland basin.

The late Mr. Griffith, mining engineer to the Royal Dublin Society, divided the Tyrone coal district into two parts, and named them the Coalisland district and the Annahone district. The Coalisland coal district, he says, is six miles long, from Mullaghmoyle on the north to Dungannon on the south, its average breadth being about two miles, making the total area something like seven thousand acres. The Annahone district is much smaller—one mile long and half a mile broad—containing about three hundred and twenty acres. It is, however, probable, according to the authority mentioned, that the district may extend a considerable distance further to the south and east, and that coal may be found beneath the red sandstone in Killymurphy and Gortnacloghan. The coal of Tyrone burns rapidly, and gives out an intense heat, and bears a strong resemblance to that of Ayrshire. In the interior of the Coalisland district great irregularity is observable in the direction and inclination of the strata. Near its southern extremity the main dip is north-east, and near the northern, south-west; but the dip is frequently altered by undulations in the strata. The direction of these undulations is generally north and south, and their curves form an arch of from ten to thirty yards in heigth, and of various breadths. These undulations cause great irregularity in the coal working by frequently changing the level, and where they occur the coal is found thin and impure, and in many instances is altogether lacking for a length of twenty or thirty yards.

The Commissioners in their report calculate the Tyrone yield at 34 million-odd tons, and the Ballycastle at 13 million-odd tons. The other coalfields of Ireland are calculated on proved data at 180 million tons, and of that total the Kilkenny (Castlecomer) coalfield contributes 160 million tons. Practically three-fourths of the proved coal reserves of the country are in the Kilkenny area, and of the 92,000 tons mined in 1918 no less than 63,675 tons were in that area. The coal in the Leinster and Munster fields is of good quality, mainly anthracite, but the seams are all shallow, uniformly 20 in. That means high cost in mining, since so much "dirt" has to be taken out above and below the seam with the coal, to give head-room for working. As the Inquiry Committee put it, the real difficulty is not the amount of reserves, but the thinness of the seams in Leinster and Munster that accounts to a large extent for the circumstances that the annual output per underground worker in Ireland is only 140 tons, as against 294 tons in Great Britain. In the face of economic facts, it is rather difficult to see how the output of 500,000 tons per annum, which the committee suggests, might be achieved, can be accomplished.

**British Contracts for British Firms.**—The *Daily Telegraph* says that officials of all city and borough corporations and urban district councils of the country have been asked by the British Empire Union to pass resolutions providing that no contracts should be given to any foreign firm connected directly or indirectly with former enemy Powers, and that preference should always be given to British firms employing British labour. A number of corporations have intimated that they have adopted resolutions along these lines.

**Domestic Smoke.**—A short interim report by the Ministry of Health Committee on Smoke and Noxious Vapours Abatement, recently published, while not recommending any particular scheme of general domestic heating, makes several suggestions regarding the use of electricity or gas. The Committee considers that heating schemes should be incorporated in houses now being constructed, and the question of cost is thought to be the chief factor in deciding the method. The report concludes with the following remark:—"With regard to the question of domestic heating in general, we are struck by the absence of full and scientific knowledge."

**Electric Safety Lamp.**—In an abstract of a paper read before the Institution of Mining Engineers, the *Colliery Guardian* gives details of a new type of miner's lamp, the "Oldham" patent cap type.

The main idea has been to embody, as far as practicable, such features as have been proved to be most satisfactory during 10 years' experiments and experience in standard electric safety lamp practice. The main constructional features are, first, the fitting actually worn on the cap, which, in order to ensure a minimum weight, consists of an aluminium piece shaped suitably to receive a silvered reflector, which is screwed to take the lens ring, which in turn secures and holds the lens in position. The lamp-holder is secured to the inner side of the cap-fitting body, being connected electrically by means of special contacts to a cable attached to one pole of the accumulator. The cap-fitting connection to one pole of the accumulator is made by means of a direct circuit through a specially strong rubber-covered cab tire cable, carried and secured to the cap lamp fitting by means of a metal containing-tube supporting an ebonite block, from which connection is made to the filament bulb. The return connection to the accumulator case is by means of rubber-covered cab tire cable protected by flexible brass tubing.

The accumulator containing-case consists of heavily tinned sheet-iron coated with anti-sulphuric paint. The connections to the two leads in the cap lamp fitting from the accumulator terminals are made by means of spring plungers contained in specially designed ebonite insulating blocks, so as to obviate the use of spring connections on the terminals of the accumulator. Suitable lead plug rivet blocks are provided both on the accumulator containing case and on the cap lamp fitting. The cap worn by the user of this type of lamp is of special design, and has attached to it a fibre plate to which the cap lamp fitting is clipped. The plate is so arranged that the weight of the cap lamp fitting itself is not borne on one position of the head, but is distributed, whilst the loop at the back enables the cable to maintain a central position over the head and down the back. The bulb is of 2 volts and 0·5 ampere, having a nominal candle-power equal to 0·7 reflected candle-power, which is equivalent to 1·6, and gives a beam extending over an area of 10 ft. at a distance of 2½ ft. A special design of flange-tight switch fitted on the accumulator containing-case enables the light to be controlled as required.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

At the Summer Meeting of the Railway Electrical and Telegraph Engineers' Conference at the North British Hotel, Edinburgh, on June 22nd, MR. WILLIAM STEVENSON, who has just retired from his position as electrical engineer of the Caledonian Railway, was entertained to dinner and presented with a solid silver coffee pot. Mr. Wood, electrical engineer of the North British Railway and President of the Conference for the year, proposed the health of Mr. Stevenson. Mr. Jackson, the oldest member of the Conference, made the presentation. Mr. Stevenson suitably responded.

MR. ERNEST MORGAN, who is leaving the Yorkshire Electric Power Co., to take up the post of technical and engineering assistant to the chief engineer of the Wolverhampton Corporation electricity department, was presented recently with a combined thermometer and barometer, from the general staff of the company, and with a pair of large solid silver vases, from the operation staff, of which he has been superintendent. Mr. Morgan has been with the company for 10 years. The gifts were handed over by Mr. W. B. Woodhouse, general manager, in the presence of a large gathering.

A substantial cheque was handed to MR. JOHN MORRIS, M.I.Mech.E., on June 28th, as a testimonial for his services as Head of the Mechanical Engineering Department of the Royal Technical Institute, Salford. Mr. Morris had held the position from the opening of the Institute in 1896.

MR. W. E. HOUSE, mechanical inspector in the instrument department of the Chelmsford Works of Crompton & Co., Ltd., who is leaving to take up another post, has been presented by his colleagues with an attaché case and a fountain pen.

Aylesbury Town Council has appointed MR. ERNEST JORDAN, of Rawtenstall, as works superintendent at the electricity works, at a salary of £300 a year.

The Burnley Corporation Salaries Committee recommends that the salary of MR. J. E. STARKIE, electrical engineer, be increased from £800, by annual scale increments of £50, to the maximum of £1,000; and that that of MR. H. MOZLEY, tramway manager (£691) be increased by annual increments of £50.

Glasgow Electricity Committee has recommended that MR. ALEX. P. ROBERTSON be appointed sub-station superintendent of the electricity department in succession to Mr. Cowie, resigned, at a salary of £600, rising to £750.

On Saturday last the employés of Messrs. Simpson Bros.' magneto works, presented a stop watch to MR. H. PARK (foreman), who is leaving to start on his own account, and a gold chain to MR. R. WADE, who is going with him. Both had had over 20 years with the firm.

The Highways Committee of the London County Council recommends that MR. J. J. MCGREGOR, A.M.I.E.E., boiler house superintendent at Greenwich power station, be promoted to be assistant power station engineer, at a commencing salary of £400 plus temporary additions of 20 per cent., plus £120, making the total salary £600.

In order to deal more conveniently with his consulting work in the Lancashire district, MR. C. H. WORDINGHAM, C.B.E., M.Inst.C.E., has taken offices at 11, Mosley Street, Manchester.

The *Times* states that last week the Royal Society elected MR. H. A. L. FISHER, M.P., and SIR JAMES G. FRAZER, Fellows of the Society, under the statute governing special elections, on the ground of their having "rendered conspicuous service to the cause of science."

MR. W. T. RUSHTON is relinquishing the post of representative to the General Electric Co., Ltd., after 13 years' service, in order to take up an appointment with Messrs. Farndon's Electric, Ltd., as plant representative for London.

MR. F. C. CHEETHAM, assistant engineer to the Sale Urban District Council, has been appointed mains superintendent to the Weymouth Corporation.

**Obituary.**—MR. W. H. TAYLOR.—We regret to record the tragic death of Mr. W. H. Taylor, A.M.I.Mech.E., for some years manager of the Manchester office of Messrs. Peter Brotherhood, Ltd.. He was accidentally drowned on Tuesday, June 22nd, at Bolton Abbey, where he had gone with a party of friends for a holiday. Mr. Taylor jumped the Strid, alighted on a moss-covered stone, lost his footing, fell backwards, and was drowned. We understand the place into which he fell was of considerable depth, and he was sucked under by whirlpool effects, and never rose to the surface. His body was recovered late on Wednesday evening. The loss is very deeply felt by the firm, and a very large number of his friends attended the funeral. There were many floral tributes from the firm and his friends, including the Engineers' Club, Manchester. Mr. Taylor was in his 38th year. He leaves a widow and two children.

**Will.**—The late MR HERBERT STANDRING, a director of the Greengate and Irwell Rubber Co., Ltd., left £40,309.

## NEW COMPANIES REGISTERED.

**Torque Electrical and Engineering Co., Ltd.** (168,451).—Private company. Registered June 21st. Capital, £5,000 in £1 shares. To take over the business carried on by G. J. Walsh, G. M. Park and W. F. Poulson, as "Park and Walsh," at Salubrious Passage, Swansea. The subscribers (each with one share) are: J. Sanders, 54, Eaton Crescent, Swansea; K. Scott, 34, Bayview Terrace, Brynmill, Swansea. The subscribers are to appoint the first directors. Solicitors: Davies, Ingram and Harvey, 4, Goat Street, Swansea.

**Sheringham Daylight (Foreign), Ltd.** (168,516).—Private company. Registered June 23rd. Capital, £4,500 in 1s. shares. To develop and turn to account the invention referred to in an agreement with G. Sheringham. The subscribers (each with one share) are: G. H. Sheringham 1, Clanricarde Gardens, Bayswater Road, W.2, artist; C. C. H. Millar, 74, Upper Gloucester Place, N.W.1, engineer. The subscribers are to appoint the first directors. Solicitor: J. G. Bristow, 1, Copthall Buildings, E.C.

**Ellerd-Styles & Co., Ltd.** (168,467).—Private company. Registered June 22nd. Capital, £2,000 in £1 shares. To take over the business of an electrical, mechanical and aeronautical engineer, &c., carried on by W. Ellerd-Styles at 287, Upper Street, Islington. The first directors are: W. Ellerd-Styles, 91, Forest Drive West, Leytonstone; L. F. S. Young, 24, Brackley Road, Chiswick. Solicitor: F. Burgis, 1, Budge Row, Cannon Street, E.C. Registered office: 287, Upper Street, Islington, N.

**Stella Gill Coke and Bye-Products Co., Ltd.** (168,517).—Private company. Registered June 23rd. Capital, £300,000 in £10 shares. To manufacture coke and derive from coal all kinds of secondary residual and bye-products, dealers in such products, gases and waste-heat, to acquire, generate and, distribute gas, water and electricity, to carry on business as coal merchants, manufacturers of and dealers in chemical products, &c. The first directors are: H. G. Plunkett, Kilteragh, Foxrock, Dublin (director, John Bowes and Partners, Ltd., Pelton Steamship Co., Ltd., chairman of Owners of Pelton Colliery, Ltd.); Rose C. Bainbridge, Elfordleigh, Plympton, Devon (director, Owners of Pelton Colliery, Ltd.); B. J. H. Walsh, Stourbank, Nayland, near Colchester (director, Owners of Pelton Colliery, Ltd.); R. S. Gardener, Nardres Court, Canterbury; H. Armstrong, 4, Sydenham Terrace, Newcastle-on-Tyne. Secretary: R. M. Weston. Solicitor: S. H. Hargrove, 16, Victoria Street, S.W. Registered office: 39, Lombard Street, E.C.

**Dynamo and Motor Repairs, Ltd.** (168,374).—Private company. Registered June 18th. Capital, £10,000 in £1 shares. To carry on the business of electricians, mechanical and general engineers, dealers in electrical and motor apparatus, &c. The subscribers (each with one share) are: H. W. Bosworth, 28, Victoria Street, Westminster, S.W., electrical engineer; C. R. Bates, 27, Martin's Lane, E.C.4, electrical engineer. Electrical Installations, Ltd., shall have the right, while holding 500 shares, to nominate a director. The first directors are not named. Registered office: Mapesbury Works, Willesden Lane, Kilburn, N.W.

**Castlederg Electric Supply Co., Ltd.** (5,017).—Private company. Registered in Dublin, June 18th. Capital, £6,000 in £1 shares. To carry on the business indicated by the title. The subscribers are: S. Galley, Main Street, Castlederg, provision merchant, 100 shares; J. Crockett, Main Street, Castlederg, provision merchant, 200 shares. The first directors are not named. Solicitor: T. E. Nelson, 24, St. Andrew Street, Dublin.

**Fred H. Pickering, Ltd.** (168,438).—Private company. Registered June 21st. Capital, £10,000 in £1 shares. To take over the business of an electrical engineer carried on by Fred H. Pickering at 6, Stanley Street, Bury. The first directors are: F. H. Pickering (managing director), 6, Stanley Street, Bury; S. Preston, 21, Startha Road, Birkby, Huddersfield; J. Preston, Elsinore, Manchester Road, Bury, Lancs. Solicitor: C. H. Pickstone, The Bridge, Radcliffe, Lancs. Registered office: 6, Stanley Street, Bury.

**Welded Construction, Ltd.** (168,425).—Private company. Registered June 19th. Capital, £10,000 in £1 shares. To take over the business carried on by Industrials, Ltd., as the Welded Construction Co., to carry on the business of builders, contractors, electrical engineers, suppliers of electricity, founders, &c., and to enter into an agreement with the said company and the Alloy Welding Processes, Ltd. The first directors are: W. A. Hunter, Charlton Lodge, Thornton Heath; D. G. Boissevain, 49, Thurloe Square, Kensington; E. H. Jones, Duxbury, Kew Road, Richmond; J. Caldwell, M.I.C.E., M.I.E.E., Nanhans Grange, Great Missenden, Bucks. Solicitors: Slaughter and May, 18, Austin Friars, E.C. Registered office, 14-16, Cockspur Street, S.W.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Farad Electrical Co., Ltd.**—Particulars of £1,500 debentures created authorised May 29th, 1920, amount of present issue £1,000. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees.

**Napier-Kimber, Ltd.**—Second mortgage debenture dated June 14th, 1920, to secure £4,000 charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: A. W. Kimber, Chevering, The Drive, Wembley Park, N.W.

**Rayner & Heald, Ltd.**—Issue on June 1st, 1920, of £4,000 debentures, part of a series.

**Dodd & Oulton, Ltd.**—Mortgage on June 15th, 1920, to secure £10,000, charged on 8-12, Stanley Street, Liverpool. Holders: Mrs. C. B. Hemelryk, The Priory, Gateacre, Liverpool, and others.

**Willey & Co., Ltd.**—Satisfaction in full on January 1st, 1920, of trust deed dated December 29th, 1904, securing £20,000.

## CITY NOTES.

**United Electric Tramways of Montevideo, Ltd.**

Presiding at the annual meeting, last week, Sir G. A. Touche, Bt., said that the business was now burdened with a standard of expenditure which was never contemplated when the concession was granted and the fares fixed, but, in spite of all the efforts of the board, they had not yet obtained the required authority to make the increase in tariffs necessary to bring them into some sort of correspondence with the altered conditions. The equity of their claim for an increase was incontrovertible. There had been a general recognition of the fairness of the claim for revision of rates which public utility companies were authorised to charge, and he did not suppose that Uruguay would separate herself from other nations in that respect. If she had been later than some countries in giving legislative effect to the necessary changes, it was probably owing to questions of procedure rather than any unwillingness on the part of her statesmen to recognise how circumstances had altered. Since the low level reached in the first year of the war the traffic receipts had been steadily progressing, and there had been a marked increase of travel during the year under review. That was a welcome indication of greater business prosperity and activity in the Republic. The traffic receipts for the year were £449,694, an increase of £63,394. Although the company represented only part of the tramway system of the city, they had carried the equivalent of the entire population 152 times over, as against 132 times in the previous year. The dark side of the picture was that which showed the operating expenses. The coal bill, although £12,000 less than in 1918, was three times what it was in 1915; the average cost per ton c.i.f. Montevideo last year was 114s. There had also been a substantial increase in the wages bill, while repairs and maintenance had cost considerably more than in previous years. £30,000 had been placed to renewals and contingencies account. In doing this they were reverting to the provision set aside in the years immediately preceding the war, and which they then hoped would not be a maximum amount. Owing to the greatly increased cost of all materials and of labour, the rate of pre-war provision should be increased rather than diminished. While it was satisfactory to be able to deal with the arrears of dividend on the preference shares, the board regretted that no recommendation could be made for the payment of any dividend on the ordinary shares. Holders of those shares had now been without any distribution for five years, and since the company was formed, the average annual return had been only 3¼ per cent. Such an experience, if maintained, was not likely to encourage the investment of capital in Uruguay. He did not, however, take a despondent view of Uruguay in that respect, and it would be a glad day for the friends of Uruguay when events showed that their faith had been vindicated. Dealing with the case of a revision of tariffs and the course the negotiations and proceedings had taken, the chairman said that so far the course of events confirmed the belief that the question would be decided purely on its merits, but, unfortunately, a new complication had recently developed. A question had arisen between the Representative Assembly and the municipality as to which had the right to determine whether a tariff revision should be authorised, and while the company were waiting for its solution, valuable time was being lost. They had fulfilled their share of the contract on the understanding that they would receive a certain recompense, but they were not obtaining it.

**Marconi Wireless Telegraph Co., Ltd.**

The annual meeting was held on Tuesday at the Connaught Rooms. Senatore G. Marconi, G.C.V.O., LL.D., presided, and, after reviewing the financial result, he said that their various affiliated companies were making progress, and the reconstruction of the Canadian company had been completed, and the company was now in a financially sound position. No settlement had been made with any of the Government departments in respect of any of the company's claims arising out of the war or for services rendered during the war, and no sum in respect of any of those claims appeared in the accounts. The arbitration which had been agreed with the Admiralty in respect of the Lodge patent had just been concluded, but Lord Moulton, who had acted as arbitrator, had not yet delivered his judgment. They might, however, confidently expect to have that very shortly, and they thought there should then be no reason for any further delay in coming to an amicable settlement of their claims against the Admiralty, the War Office, and the Air Ministry. With regard to the services rendered in respect of which they had a claim pending against the Post Office, they were still hoping that that also might be settled ere long in an amicable way. In that hope they had stayed their proceedings under the Petition of Right. Having referred in detail to the various countries and places where the company's wireless telegraph service had been extended, Mr. Marconi proceeded to refer to the matter of the establishment of an Imperial chain of wireless stations which had been under the consideration of a Parliamentary Committee, of which Sir Henry Norman was chairman. He said he thought he might safely claim that no company in the world, or Government, possessed as much knowledge or experience of matters such as the committee were asked to consider as did that company. They were the first to conduct a long-distance wireless telegraph service; they were the only ones to have conducted such a service from this country; and the knowledge, experience, and information which they possessed as a result of their many years' work was very valuable to them, and would be of the highest value to many others. It was with great regret that they felt obliged to decline to give evidence before the committee so long as Sir Henry Norman was its chairman, having regard to the correspondence which that gentleman conducted right up to the outbreak of the war with a German competitor. That correspondence could leave no possible doubt that Sir Henry Norman was not only biased against the Marconi Co., but that what he learned in respect of the Marconi Co., either as to scientific development or otherwise, he was ready to communicate to that German competitor. Further, it was manifest from the correspondence that he was contemplating becoming chairman of an English company with which that German firm was to have been associated, in order to compete with the Marconi Co. That competitive company had since come into existence. They did not know what, if any, foreign interests it might have, nor yet who might be associate with it, either now or hereafter. It was no doubt no more than a coincidence that the report of the committee, although dated May 28th, should have been published the very day they were holding that meeting. So far he had not seen a copy of it, and therefore he could not discuss it with the necessary thoroughness, but they might find another occasion shortly to do so. Referring in conclusion to the technical progress made by the company, he said that very considerable advances had been made by Capt. H. J. Round in the practical application of what were termed ionic valves, especially in regard to long-distance transmission. The valves had not only proved their usefulness for long-distance work, but had also considerably increased the range and practicability of medium and short-distance stations. Many new patents which he considered of value had been taken out or applied for, and a new device with which he first carried out tests on ships of the Italian Navy had been considerably developed by Mr. C. S. Franklin. By means of that arrangement the electric waves were propagated in a beam in any desired direction only, instead of being allowed to spread out in all directions. The advantages of the system were obvious, as it absolutely prevented stations outside of a certain angle being able to receive messages or signals which were not intended for them, besides greatly reducing mutual interference. In addition, it was likely to be of inestimable value to ships and shipping as an aid to navigation during fogs, and in minimising all risks of collision. In order to thoroughly test that and other similar devices under the actual conditions prevailing at sea, he had lately equipped an ocean-going yacht with all the necessary apparatus, and, during a recent voyage to the Mediterranean, the great value of direction finding appliances was most clearly

demonstrated. Great progress had also been made not only in wireless telegraphy, but in wireless telephony, which must very soon be turned to very considerable commercial account, both in respect of telephoning without wires and in the application of their recently acquired knowledge to telephones with wires.

Mr. Godfrey C. Isaacs referred at considerable length to the Norman Committee's proposals. He criticised severely the figures which Mr. F. J. Brown, the assistant secretary to the General Post Office, had submitted to the committee, and said he had no doubt that when the matter was considered by Parliament the figures when they were looked into would be very different to those which had formed the basis of the report. When the matter was before the Courts in 1919, the Post Office declared that the Poulsen arcs which they were then erecting, were the most up-to-date service, and would do all that was required, and that they required no Marconi patents. As a matter of fact, all the evidence went to show that the Poulsen arcs belonged to the Marconi Co., but that they were obsolete. Since then great strides had been made with the thermionic valves, but the committee had had very little up-to-date information on that point, because the only people who could give the information was the Marconi Co. Although it was admittedly outside their terms of reference, the committee recommended that the Imperial chain of wireless stations should be State owned. Personally, he was very confident that that would never be the case. Supposing, however, the stations were going to be built and worked and owned by the State, they must have the thermionic valve. That valve was controlled by a number of very important master patents, and most of them were patents taken out by gentlemen in the Marconi Co. There were some very important ones which had been taken out by very able people in America, and others equally important which belonged to the Germans. He did not care, however, which form of thermionic valve the Post Office used—whether it was American, German, or English, as all those master patents were the property in the whole of the British Empire of the Marconi Co. Even if they did not build stations they would be entitled to a very substantial royalty on the working, so he feared nothing whatever from the report of the committee. He might say that the estimated figures of the cost of establishing the system as given in the report were absolutely absurd.

**British Electric Traction Co., Ltd.**

Gross profit for the year ended March, 1920, £246,717, against £250,214 for the previous year; general expenses, £35,401; net profit, £211,316 (against £213,324 in the previous year), plus £130,952 brought forward. After deducting debenture stock interest, £87,996; putting £8,035 to reserve; paying 6 per cent. on the cumulative participating preference stock, £42,765; and paying 4 per cent. on the ordinary stock, £53,050; £150,422 remains to be carried forward. The aggregate receipts of the associated companies continue to show an increase, which is, however, more than offset by the increased cost of operation, due to the continued rise in the price of materials, in the rates of wages, and the introduction of the 48-hour week. The investments stand at £4,027,792, a decrease of £255,944, due to sales of undertakings and realisations of investments. The investments yielded a revenue of £212,747, representing an average of 5.28 per cent. for the year, as compared with 5.08 per cent. for the preceding year. Mr. C. Jermyn Ford has resigned his seat on the board, and Mr. J. S. Austen has been appointed a director.

**Imperial Tramways Co., Ltd.**

Available balance, £24,416. After paying debenture stock interest and preference dividend of 6 per cent. (less tax), 4 per cent., less tax, is to be paid on the ordinary capital and £966 carried forward. The Middlesbrough, Stockton and Thornaby Electric Tramways had £114,260 gross receipts, an increase of £7,736. Passengers carried increased by 987,227. Net profit for the year was £14,498, against £18,966 for the previous year. Continued advance in cost of operation reduced the net revenue. Arbitration proceedings are in progress with reference to the transfer of the undertaking to the three Corporations, but until the purchase price is fixed the company continues to work the system. The Imperial Company has again received no dividend on the preference or ordinary capital held in the London and Suburban Traction Co., Ltd.

**French Companies.**

*The Compagnie Générale des Cables de Lyon* intends to make a distribution of 50 fr. per share for 1919, as in the preceding year, the net profits having been 308,000 fr. as against 282,000 fr. in 1918.

The directors of the *Compagnie Parisienne d'Electricité* have decided to pay a dividend at the rate of 4 per cent. for 1919 out of net profits of 3,783,000 fr., this comparing with the same rate and net profits of 5,601,000 fr. in 1918.

The report of the *Compagnie Continentele Edison of Paris* states that the general economic situation in 1919 did not permit of the development of the electrical industry as much as desired. On the other hand, the difficulty of carrying out internal installations brought about some delay in the progress of the company's various affairs. The net profits reached 680,000 fr., and the dividend is at the rate of 30 fr. per share, being the same rate as in 1918.

*The Compagnie Française Thomson-Houston*, reporting on the past year, states that despite a combination of unfavourable circumstances common to all industrial undertakings the results obtained in 1919 were satisfactory. The volume of orders was increasing, and the development of the undertaking was proceeding in a favourable manner. As net profits the accounts show the sum of 15,685,000 fr., as compared with 13,566,000 fr. in 1918, and the dividend is at the rate of 40 fr. per share for last year.

*The Compagnie Générale de Télegraphie Sans Fil* reports that the company's activity was extended in 1919 to various countries where permitted by legislative and administrative regulations, and the results obtained caused the future to be looked forward to with confidence. Agreements were entered into with the American New Radio Corporation in regard to the rights held in the Tuckerton station, and the French company had become the exclusive agent for the former in France. The net profits are returned at 2,525,000 fr. and a dividend has been declared at the rate of 40 fr. per share.

---

**J. G. White & Co., Ltd.**—The report for the year ended February 29th, 1920, shows a net profit of £28,052. During the year the company amalgamated its construction department with that of Dick, Kerr & Co., Ltd., and formed a new company called the Consolidated Construction Co., which will carry out and fulfil all the current construction contracts of Dick, Kerr & Co., Ltd. The whole of the capital of the new company is owned by J. G. White & Co., Ltd., and the management of it is under its supervision. After paying 7 per cent. on the preference shares and 7 per cent., less tax, on the ordinary, £30,000 is put to reserve, and £15,286 carried forward.

**Globe Telegraph & Trust Co., Ltd.**—Net revenue for year ended May, 1920, after deduction of expenses, £263,950, plus £1,629 brought forward. Total distribution on the ordinary shares 10 per cent., free of tax. £7,000 to reserve for contingencies. During the year the company issued 60,376 ordinary shares, offering them to existing holders, in order to pay for allotments of new capital issued by the Eastern, Eastern Extension and the Western Telegraph Companies. The proceeds of the sale of the whole of the company's holding in the Central and South American Telegraph Co. and sales of other stock, &c., have been re-invested in the stock and shares of the Eastern, Eastern Extension and Western Companies.

**New General Traction Co., Ltd.**—Profit £11,970, plus £7,818 brought forward. Dividend 4 per cent., less tax, carrying £9,308 forward. The profit of the Norwich Electric Tramway Co. was reduced by £2,484; greater part of its profits put to reserve, track reconstruction, &c.; dividend 2 per cent., as last year. Douglas Southern Electric Tramway Co., after deducting from the satisfactory profit, the balance of loss brought forward resulting from expenditure on upkeep during long close down, had a balance of £2,134 remaining, and it is carried forward; prospects of Manx season excellent.

**Prospectus.**—*Low Temperature Carbonisation, Ltd.*—The list is to close to-morrow, Saturday, in an issue of 250,000 ordinary shares of £1 each at par. The principal object of the company is the erection and operation of works for the carbonisation or conversion of raw coal by special process. Important contracts have been made with the Yorkshire Electric Power Co., the Sheffield Corporation, and Messrs. Steel, Peech & Tozer, Ltd., for the supply of gas for electrical generation and industrial purposes.

**Waygood-Otis, Ltd.**—Mr. H. C. Walker stated at the annual meeting, on June 25th, that the net profit for the year was £48,760, against £27,252 in the previous year. Finance was still quite difficult, as stock and work in progress showed; it was approximately £90,000 more than in the previous year, and for that reason they had had to adopt a conservative distribution of dividend—7½ per cent. on the ordinary shares.

**Electro-Bleach & By-Products, Ltd.**—Profit for 1919, after deducting repairs, standing charges, depreciation, bonus to employés, directors' additional remuneration, and E.P.D., £34,637, plus £394 brought forward. Dividends 7 per cent. on the preference and 14 per cent. on the ordinary; £5,000 to reserve; £4,277 carried forward.

**Shawinigan Water & Power Co.**—Dividend of 1¾ per cent. on the common stock for the quarter ended at June.

**Peterborough Electric Traction Co., Ltd.**—Dividend of 12 per cent. on preference shares for two years to December, 1917. £1,500 to reserve; £3,000 to renewals; £4,496 to repairs and maintenance; £1,861 forward.

**British Columbia Telephone Co.**—Dividends for year ended March, 1920, 8 per cent.; $10,000 to contingent reserve, and $6,383 forward.

**Edgar Allen & Co., Ltd.**—Final dividend of 2s. per share on the ordinary, making 3s. for the year, free of tax. To reserve £20,000. Carried forward £47,568.

**Anglo-Portuguese Telephone Co., Ltd.**—Final dividend of 4 per cent., less tax, for 1919.

**Simms Motor Units (1920), Ltd.**—Mr. F. W. Simms, presiding on June 23rd at the statutory meeting, said that the new Grange works had made good progress, and in two or three months they expected to be able to commence the manufacture of their new four-cylinder light car type of magneto. The motor accessory department had been removed to the new establishment, and they intended to develop this lucrative adjunct to their business, for large markets existed for their sparking plugs, magnetic petrol gauges, mechanical and electrical horns, vulcanisers, and magneto couplings. The magneto repair and spare part departments were progressing very satisfactorily, and formed a substantial and steady source of profit. Owing to the growth of the company's dynamo and electric motor repair department this had just been removed to Percy Street, W. The main works were mainly engaged upon magneto production for the leading commercial vehicle manufacturers, and were progressing well and satisfactorily.

**Ericsson's Mexican Telephone Co.**—The report for 1919 of the directors of the Mexikanska Telefon Bolag Ericsson has been issued, announcing an increase in the number of subscribers last year, and a further expansion down to the end of April, 1920. The circulating medium in the country was formed of metallic currency, and a specially advantageous relationship was established between Mexican and Swedish exchange, resulting in considerable profits on remittances from Mexico. It was impossible to secure permission to raise subscriptions last year, but it is hoped to receive sanction to do so this year. The net profits amount to 200,925 pesos, as compared with 195,134 pesos in 1918, and the directors recommend a dividend at the rate of 6 per cent., as in the previous year, together with an extra 2 per cent. derived from the profits on exchange.

**Crompton & Co., Ltd.**—Net profit for year ended March, 1920, £52,878 plus £17,409 brought forward. £15,000 to general reserve; £9,000 to depreciation of investments; dividend 10 per cent. on the preference shares; dividend 10 per cent. on the ordinary shares; £18,177 carried forward.

**General Electric Co., Ltd.**—The report received just as we go to press shows that for the year ended March, 1920, the net profit was £630,143. In the previous year it was £480,828. The dividend on the ordinary shares is 10 per cent., free of tax. £85,329 is put to depreciation; £150,000 to reserve; £40,000 to Superannuation Trust Fund; and £251,423 is carried forward subject to E.P.D.

**Direct Spanish Telegraph Co., Ltd.**—After payment of income tax and Excess Profits Duty for 1918, the accounts for 1919 show a balance of £34,794. Preference dividend 10 per cent., £3,000; 7 per cent. dividend and 3 per cent. bonus on ordinary, £6,465; to reserve, £5,000; carried forward subject to E.P.D., £20,328. Two interruptions of the company's Bilbao cable occurred during the year; the necessary repairs were effected after interruptions of 37 and 17 days respectively at a cost of £36,494, which includes the renewal of 150 knots of old cable, and which has been charged to revenue. Mr. F. T. Preddle, whose services to the company extended over a period of 47 years, and who occupied the position of secretary since May, 1902, resigned in December, and Mr. C. E. Morgan, who joined the company in 1874, has been appointed in his place.

**The Swedish Luth & Rosen Co.**—The registration notice has now been published for the new company which is to take over the business of Luth & Rosens Elektriska A.B., by way of reconstruction. The share capital is put at a minimum of 12,000,000 kr., and a maximum of 36,000,000 kr. divided into shares of 100 kr., and preference shares can represent 8,150,000 kr. out of the total capital, bearing 10 per cent. cumulative. The present company will subscribe for 81,470 ordinary shares in the new company, which is supported by the Svenska Emissions A.B. The transfer of the undertaking to the new company has just been confirmed at an extraordinary meeting.

**Stock Exchange Notices.**—The Committee has specially allowed dealings in the following under Temporary Regulation 4 (3):—

Callender's Cable & Construction Co., Ltd.—100,000 new ordinary shares of £1 each, issued at 22s., of which 15s. is paid, Nos. 400,001 to 500,000; and 400,000 7½ per cent. "B" cumulative preference shares of £1 each, 15s. paid, Nos. 1 to 400,000, after issue of allotment letters.

Hydro-Electric Power & Metallurgical Co., Ltd.—56,250 ordinary shares of £1 each, fully paid, Nos. 181,001 to 237,250.

Midland Electric Corporation for Power Distribution, Ltd.—200,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 200,000.

**Aluminium Corporation, Ltd.**—The report for the three years ended December, 1919, shows that the balance at credit of profit and loss, after deducting debenture interest and preference dividends to December, 1918, amounts to £60,624. A dividend for the year 1919 of 7 per cent., less tax, upon the preference shock and shares is recommended, and £30,000 is to be placed to reserve against imperial taxation and special depreciation, the balance of £18,978 being carried forward. Since the close of these accounts the Llugwy dam has been completed, and considerable progress has been made with the construction of the Cowlyd dam.

**Taunton Electric Traction Co., Ltd.**—The receipts for 1919 were £4,705 (including £293 brought forward), against £3,813. After meeting expenditure, paying debenture interest, and putting £750 to renewals, £214 is to be carried forward.

**India-Rubber, Gutta-Percha & Telegraph Works, Co., Ltd.**—Interim dividend of 2½ per cent., free of tax, on ordinary shares.

**Victoria Falls & Transvaal Power Co.**—Dividend on the ordinary shares of 5 per cent., less tax, in respect of 1919.

## STOCKS AND SHARES.

Tuesday Evening.

The turn of the half-year having been accomplished without any further rise in the Bank Rate, the Stock Exchange markets are thankful for the small mercy of a 7 per cent. minimum, and the prophets begin to talk of a possible easing of the monetary situation. Close observers decline to commit themselves to any optimistic speculation at present, and are content to say that we are by no means out of the wood of dear money yet. Meanwhile, the trading community continues to feel the effect of the scarcity of financial accommodation. For good or for evil, the five banking powers hold a tight grip over the situation. The man wanting capital which is refused by one bank, finds—sometimes to his surprise—that other banks are equally inflexible. Employers of large bodies of workpeople earning weekly wages are realising the value of liquid cash resources as compared with large amounts of stocks, and the problem of financing business may loom more largely than the obtaining of orders. Labour goes on making more and ever greater demands in the matter of money and hours.

These factors investors know and realise. With his business calling for cash, the employer has little to spare outside his own sphere. Therefore industrial shares tend to languish in price. Callenders found a good response for their new issue; it will be interesting to know if the underwriters are left with any part of their engagements. Many other industrial companies would probably like to issue new capital, but the times are not auspicious. Several important concerns have decided to postpone appeals to the public.

The White Paper issued as a sequel to the interrupted speech of Sir Eric Geddes in connection with the position of the railways was not out at the time the Stock Exchange closed this (Tuesday) evening, but its expectation brought about improvement in a few cases. Metropolitans, for instance, have risen 1¼ to 21¼. Underground Electric ordinary shares, however, are back at 35s. Naturally, curiosity is greatly piqued by the reference made by Sir Eric Geddes to the arrangement between the Metropolitan and the District companies with the Government, and it is held that this bargain was a shrewd one from the point of view of the companies. Possibly the latter, however, are disappointed that it has taken so long for them to get permission to raise fares, which permission has, of course, still to be granted by Parliament. According to the White Paper, the railway companies are to be arranged in groups with a view to elimination of competition and reduction of expenses in other directions. The sixth group is that of London local lines, which for practical purposes are already conformed to the Government scheme.

From the spectacular point of view, the principal movements of the past few days are those in Mexican securities. Prices have gone up very substantially, and the Utilities advanced with the rest. Indeed, the improvement is sufficiently noticeable to make comparison interesting between to-day's levels and the lowest which prevailed only two or three weeks ago. The reason for the recovery is that advices from Mexico certainly encourage the idea that, for the *n*th time, there seems to be firm hope that order may be restored in the country. We give a few representative examples:—

| Stock. | Lowest. 1920. | Now. | Rise. |
|---|---|---|---|
| Mexican Light and Power Common ... | 10 | 14 | 4 |
| Mexican Light and Power Prefd. ... | 15 | 26 | 11 |
| Mexican Light and Power 1st Mort. ... | 34 | 50½ | 16½ |
| Mexican Light and Power 2nd Mort. ... | 21¼ | 36¼ | 15 |
| Mexico Tramways Common ... ... | 14¾ | 17½ | 2¾ |
| Mexico Tramways 1st Mort. ... ... | 26¾ | 40½ | 13¾ |
| Mexico Tramways 2nd Mort. ... ... | 18½ | 30 | 11½ |
| Pachuca Bonds ... ... ... ... | 30 | 41½ | 11½ |
| Monterey Deb. ... ... ... ... | 29 | 29½ | ½ |
| Mexican Electric Fives ... ... ... | 21¼ | 40¼ | 19 |
| Mexican Northern Power ... ... | 8 | 15½ | 7½ |

The rises produced little business, because people naturally decline to sell when the outlook is brighter in exactly the same way as they refuse to buy when the position offers little hope. Obviously, however, a determined effort is being made this time to reorganise Mexican matters, and the present form of government is adopting methods both businesslike and sensible in its efforts towards restoration of order. It may take some time for Mexico to find its financial legs again, but once the corner is turned, the recovery should be progressive, though setbacks and disappointments can hardly be avoided from time to time.

The market for electricity supply shares is little better, although a rise in Westminster ordinary to 5½ is a slight indication of the investor's appreciation of the yields to be obtained from this section. County ordinary are still very dull, and the improvement of last week in City Lights has been lost, the shares reverting to 22s. 6d.

Edison-Swans slipped back to 25s. upon absence of any authentic news regarding the rumours of amalgamation which were circulated a fortnight ago, and which had the effect of putting the price up to 27s. 6d. British Insulated drooped to 36s. 3d. Electric Constructions at 20s. are ex their dividend and bonus, and India-Rubber shares at 13 are x.d. Callenders went back to 27s. 6d., also ex dividend, and the old preference shares are 17s. 6d. Electric and General Investment preference at 2¼ ex the dividend of 3s. are a trifle lower. There has been a little business during the past few days on the basis of 49s. cum dividend. English Electrics are steady at £1, and the preference 15s. 3d. Edmundsons' ordinary have gone back to 5s. Shanghai Electrics fell 10s. to 15½.

Eastern Telegraph ordinary has lost 2 points at 145½, and Westerns, on the other hand, after recovering their dividend, fell back to 15. Great Northerns have risen to 23½ on the report just out, the figures being very satisfactory; while, on the other hand, Indo-Europeans at 32½ are 50s. lower. Anglo-American deferred is ¼ down; Cuba Submarines and Oriental Telephones lost ½ and ¼ respectively. Marconis, after their excited rise to 75s., have come back to 66s. 3d., in sympathy with the dulness which is apparent in many of the other industrial parts of the Stock Exchange. The new shares have gone back to 2¾, and Canadian Marconis are practically neglected. Armament shares have sagged on talk of possible new issues. A decline in raw rubber to 1s. 11d. per lb. has had a slightly adverse effect upon the market for rubber shares.

## SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend 1918. | Dividend 1919. | Price June 29, 1920. | Rise or fall. | Yield p.c. |
|---|---|---|---|---|---|
| **HOME ELECTRICITY COMPANIES.** | | | | | |
| Brompton Ordinary | 8 | 12 | 62 | — | £9 8 2 |
| Charing Cross Ordinary | 4 | 7 | 84 | — | 10 0 0 |
| do. do. do 4½ Pref. | 4½ | 4½ | 92 | — | 8 8 8 |
| Chelsea | 3 | 4 | 54 | — | 8 0 0 |
| City of London | 8 | 10 | 14 | — div | 8 17 10 |
| do. do. 6 per cent. Pref. | 6 | 6 | 17/- | — | 7 1 2 |
| County of London | 7 | 8 | 84 | — | 9 17 0 |
| do do. 6 per cent. Pref. | 5 | 5 | 82 | — | 7 5 5 |
| Kensington Ordinary | 6 | 7 | 4 | — | 8 15 0 |
| London Electric | Nil | 2½ | 1½ | — | 6 0 0 |
| do. do. 6 per cent. Pref. | 5 | 5 | 5 | — | 10 0 0 |
| Metropolitan | 5 | 6 | 75 | — | 10 8 8 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 2½ | — | 8 0 0 |
| St. James' and Pall Mall | 10 | 12 | 62 | — | 8 16 10 |
| South London | 5 | 5 | 55 | — | 9 12 0 |
| South Metropolitan Pref. | 7 | 7 | 18/9 | — | 7 0 0 |
| Westminster Ordinary | 8 | 10 | 5½ | + ¼ | 9 15 2 |
| **TELEGRAPHS AND TELEPHONES.** | | | | | |
| Anglo-Am. Tel. Pref. | 6 | 6 | 73½ | — | 7 12 10 |
| do. Def. | 85/6 | 14 | 172 | — ½ | 8 9 0 |
| Chile Telephone | 6 | 6 | 64 | — | *4 18 2 |
| Cuba Sub. Ord. | 7 | 7 | 8½ | — ¼ | *8 4 8 |
| Eastern Extension | 8 | 10 | 144 | — | *6 18 0 |
| Eastern Tel. Ord. | 8 | 10 | 145½ | — 2 | *6 17 6 |
| Globe Tel. and T. Ord. | 8 | 10 | 154 | — | *6 7 0 |
| do. do. Pref. | 6 | 8 | 87 | — | 6 17 2 |
| Great Northern Tel. | 22 | 22 | 23½ | +2 | 9 17 2 |
| Indo-European | 18 | 10 | 32½ | +2½ | 7 13 10 |
| Marconi | 25 | 25 | 3 7/16 | — 3/16 | 7 11 1 |
| Oriental Telephone Ord. | 10 | 12 | 9 7/16 | — ¼ | *5 4 4 |
| United R. Plate Tel. | 8 | 8 | 7½ xd | — | *6 12 8 |
| West India and Panama | 1/8 | Nil | 1/16 | — | Nil |
| Western Telegraph | 8 | 10 | 15 xd | — ½ | *6 13 4 |
| **HOME RAILS.** | | | | | |
| Central London Ord. Assented | 4 | 4 | 44½ | — | 8 19 9 |
| Metropolitan | 1 | 1½ | 21½ | +1½ | 5 16 8 |
| do. District | Nil | Nil | 15 | — | Nil |
| Underground Electric Ordinary | Nil | Nil | 1½ | — ¼ | Nil |
| do. do. "A" | Nil | Nil | 4/6 | — | Nil |
| do. do. Income | 5 | 4 | 59½ | — | 6 14 6 |
| **FOREIGN TRAMS, &c.** | | | | | |
| Anglo-Arg. Trams. First Pref. | Nil | 5½ | 32 | — | 8 3 0 |
| do. do. 2nd Pref. | Nil | Nil | 8½ | — | — |
| do. do. 5 Deb. | 5 | 5 | 59 | —1 | 8 9 6 |
| Brazil Tractions | Nil | — | 47 | —2 | — |
| Bombay Electric Pref. | 6 | 6 | 13 | — | 4 10 0 |
| British Columbia Elec. Ry. Pfce. | 5 | 5 | 57½ | — | 8 13 0 |
| do. do. Preferrred | 2½ | 5 | 53½ | — | 9 7 0 |
| do. do. Deferred | Nil | 3 | 55½ | +3 | 5 12 3 |
| do. do. Deb. | 4½ | 4½ | 52½ | — | 8 2 0 |
| Mexico Trams 5 per cent. Bonds | Nil | Nil | 40½ | +8½ | Nil |
| do. 6 per cent. Bonds | Nil | Nil | 80 | +4½ | Nil |
| Mexican Light Common | Nil | Nil | 14 | +1½ | Nil |
| do. Pref. | Nil | Nil | 26 | +4½ | Nil |
| do. 1st Bonds | Nil | Nil | 50½ | +4½ | 1 17 10 |
| **MANUFACTURING COMPANIES.** | | | | | |
| Babcock & Wilcox | 15 | 15 | 7/32xd | — | *8 14 4 |
| British Aluminium Ord. | 10 | 10 | 1 7/16 | — | 9 8 2 |
| British Insulated Ord. | 12½ | 15 | 1 7/16 | — | 8 5 6 |
| Callenders | 25 | 15 | 1/8 xd | — | 10 18 2 |
| ,, 6½ Pref. | 6½ | 6½ | 1/4 xd | — | 7 8 7 |
| Castner-Kellner | 20 | 17 | 5/8 | — | 5 4 7 |
| Crompton Ord. | 10 | — | 22/- | — | 9 1 10 |
| Edison-Swan, "A" | 10 | — | 1/8 | + 1/16 | 7 12 4 |
| do. do. 5 per cent. Deb. | 5 | 5 | 7/16 xd | — | 6 5 9 |
| Electric Construction | 10 | — | 21 xd | — | 9 10 6 |
| Gen. Elec. Prof. | 6½ | 6½ | 18/6 | — | 7 0 5 |
| do. Ord. | 10 | — | 32/6 | — | *6 3 0 |
| Henley | 25 | 15 | 1½ | — | 8 0 0 |
| do. 4½ Pref. | 4½ | 4½ | 5½ | — | 8 18 6 |
| India-Rubber | 10 | 10 | 15 xd | — | *7 13 10 |
| Met.-Vickers Pref. | — | 8 | 2½ | — | 7 2 8 |
| Siemens Ord. | 10 | 10 | 26/- | — | *7 13 10 |
| Telegraph Con. | 20 | 20 | 21½ | — | *5 11 8 |

* Dividends paid free of Income Tax.

## MARKET QUOTATIONS.

**It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.**

### Tuesday, June 29th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Oxalic | per lb. | 2/10 | ... |
| a Ammoniac Sal | per ton | £100 | ... |
| a Ammonia, Muriate (large crystal) | ,, | £92 | ... |
| a Bisulphide of Carbon | ,, | ... | ... |
| a Borax | ,, | £42 | ... |
| a Copper Sulphate | ,, | £47 | £1 dec. |
| a Potash, Chlorate | per lb. | 1/- | ... |
| a ,, Perchlorate | ,, | 1/3 | ... |
| a Shellac | per cwt. | £33 | £1 10s. inc. |
| a Sulphate of Magnesia | per ton | £18 | ... |
| a Sulphur, Sublimed Flowers | ,, | £23 | ... |
| a ,, Lump | ,, | £25 | ... |
| a Soda, Chlorate | per lb. | 6d. | ... |
| a ,, Crystals | per ton | £12 | ... |
| a Sodium Bichromate, casks | per lb. | ... | ... |
| **METALS, &c.** | | | |
| g Babbitt's Metal Ingots | per ton | £115 to £345 | ... |
| c Brass (rolled metal 3" to 12" basis) | per lb. | 1/3 | ½d. dec. |
| c ,, Tubes (solid drawn) | ,, | 1/5½ to 1/6 | ... |
| c ,, Wire, basis | ,, | 1/3½ | ½d. dec. |
| c Copper Tubes (solid drawn) | ,, | 1/6½ | ... |
| g ,, Bars (best selected) | per ton | £128 | £3 dec. |
| g ,, Sheet | ,, | £128 | £3 dec. |
| g ,, Rod | ,, | £128 | £3 dec. |
| d ,, (Electrolytic) Bars | ,, | £125 | £5 dec. |
| d ,, ,, Sheets | ,, | £156 | ... |
| d ,, ,, Wire Rods | ,, | £130 | £5 dec. |
| d ,, ,, H.C. Wire | per lb. | 1/3½ | ½d. dec. |
| f Ebonite Rod | ,, | 3/- | ... |
| f ,, Sheet | ,, | 2/6 | ... |
| n German Silver Wire | ,, | 2/- | ... |
| h Gutta-percha, fine | ,, | 13/- | ... |
| h India-rubber, Para fine | ,, | 3/1½ | ... |
| i Iron Pig (Cleveland Warrants) | per ton | Nom. | ... |
| l ,, Wire, galv. No. 8, P.O. qual. | ,, | £59 | ... |
| g Lead, English Pig | ,, | £35 | ... |
| g Mercury | per bot. | £20 | 20/- to 30/- dec. |
| e Mica (in original cases) small | per lb. | 6d. to 4/6 | ... |
| e ,, ,, ,, medium | ,, | 5/- to 10/- | ... |
| e ,, ,, ,, large | ,, | 12/6 to 25/- & up | ... |
| g Phosphor Bronze, plain castings | ,, | 1/6 to 1/11 | ... |
| g ,, ,, rolled bars and rods | ,, | 2/2 to 2/6 | ... |
| d ,, ,, rolled strip & sheet | ,, | 2/8 to 2/9 | ... |
| r Silicium Bronze Wire | per lb. | 1/11½ | ½d. dec. |
| g Steel, Magnet, in bars | ,, | 1/8 | ... |
| n Tin, Block (English) | per ton | £246 to £247 | £8 inc. |
| e ,, Wire, Nos. 1 to 16 | per lb. | 4/9 | ... |
| White Anti-friction Metals | per ton | £90 to £345 | ... |

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

**Electric Furnaces for Melting Metals.**—At a recent meeting of the Birmingham Metallurgical Society a paper on "Modern Metal Melting," with particular reference to electricity, was read by Mr. A. J. G. Smout, A.I.M.M., A.I.C. He pointed out that the type of furnace which most closely approximated to the ideal was the electric furnace. There were types which melted brass quite satisfactorily, and it was, he felt, the furnace of the future. The question was often asked whether electricity was really applicable to the melting of non-ferrous metals and alloys; much depended on local conditions. What was a brilliant commercial success in the U.S.A. with cheap energy, or in Norway where it was even cheaper, might be a complete economic failure in this country, where they were paying 2½d. per unit. At such a figure there seemed little prospect for the electric melting of non-ferrous alloys becoming a practical proposition, except perhaps to a limited extent on special work where the cost of melting was quite secondary to the production of a really first-class alloy. Even with steel, the electric furnace was chiefly engaged in the manufacture of the more expensive alloys, and many furnaces had to be closed during the past 12 to 18 months on account of their inability to compete on economic grounds with other furnaces. Obviously the most economical method of melting metal by electricity was to pass the current through it, as was done in the induction furnace, but while that method was eminently suitable for steel it had many disadvantages when applied to brass. Copper and its alloys required the greatest care in melting to avoid local over-heating and loss by oxidation and volatilisation. They usually had to conform to a rigid specification, and must be quite uniform in composition with the varying constituents thoroughly alloyed. Those essentials ruled out several types of furnace which gave excellent results in steel melting. Among the advantages to be derived from melting non-ferrous metals in electric furnaces were high thermal efficiency; accurate control of temperature; no flue losses; high quality of castings, sulphurous gases being entirely excluded; and neither noise, fumes, nor excessive radiated heat.

# THE DESIGN OF A SUPER-POWER STATION.*

By H. GOODWIN, Junr., and A. R. SMITH, of the General Electric Co., U.S.A.

(*Concluded from page* 810.)

Two circuits are provided for the blowers and fans for each set of four boilers. As each boiler has two blowers and two fans, one of each would be connected to each circuit. This should ensure the operation of at least half of them, which would allow the boilers to operate at a high percentage of their rating at all times.

Since stoker motors are of small size, it is proposed to install two transformer banks, each consisting of three 37.5-K.V.A. single-phase transformers, to supply them. A double

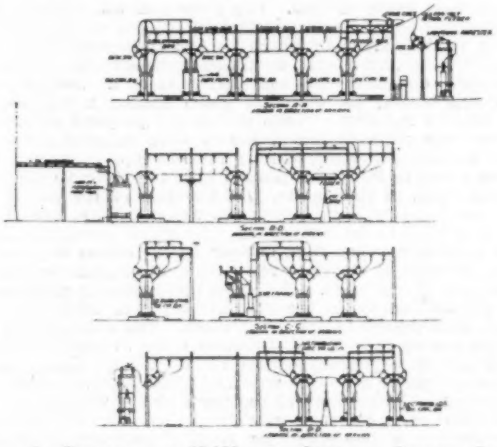


FIG. 6.—SECTIONS OF 66,000-VOLT OUTDOOR SWITCH GEAR.

circuit arrangement quite similar to that proposed for the blowers and fans is suggested, with a double-throw switch for each stoker motor.

It is proposed that the circulating pumps be driven by 2,300-volt motors with the neutral brought out for differential protection, and that this protection be provided from the oil switch on the switchboard to the neutral in the motor, thus also including the cable supplying the motor. This system will ensure the operation of the circulating-pump motors under all conditions of voltage and frequency fluctuation. For the various other auxiliaries for the turbines, two circuits are proposed with overload protection, the individual auxiliaries to be provided with no overload protection. For the smallest auxiliaries a lower voltage will probably be necessary, and it is suggested that adjacent to these auxiliaries for each turbine a bank of transformers be installed for stepping down to 240 volts.

It is proposed that boiler feed pump motors be made for 2,300 volts and protected differentially, including their cables, in a manner exactly similar to that employed for the circulating pumps, so that as long as there is any power, either from the main bus or from the auxiliary turbine, it will be possible to maintain feed to the boilers.

It is to be noted in the proposals above that complete alternating-current drive has been provided for the boiler room. Some of the most recent installations have adopted this method. Elimination of apparatus for conversion from A.C. to D.C. should increase the reliability. For the blowers and fans, brush-shifting motors are suggested. For the stokers four-speed, multi-speed motors are suggested, and if a stoker with mechanical arrangements for two speeds is used, six speeds of the stoker may actually be obtained.

Figs. 6 and 7 show the outdoor station in greater detail. Fig. 7 shows the section corresponding to one generator and the characteristic arrangement for an overhead feeder, an underground feeder, station service transformers, and tie to the next section of each bus. Fig. 6 shows sections through the outdoor structures at these various points.

The reactors to be used are of particular interest, on account of their high voltage and use out of doors. For these reasons an oil-cooled type of reactor is recommended. This consists practically of a set of transformer coils of the proper number of turns and current capacity, arranged and held just as they would be in a transformer, except that the iron core is omitted. Such units would be water-cooled like transformers, but the quantity of water required would be comparatively small.

The high voltage of the cables proposed necessitates particular arrangements for testing them on installation and after repairs. Also, it is considered that it would be better practice to test any cable before it is put back in service, after the switch controlling it has opened automatically. This means that arrangements must be made for making quick tests. To accomplish this a testing set is to be placed in one of the galleries, and from this a connection made to the test bus outdoors, shown in fig. 7. Disconnecting switches are located at convenient points along this test bus so that flexible cables can be carried easily from one of them to the cable to be tested. This arrangement, considered in connection with the fact that the operator can view the whole

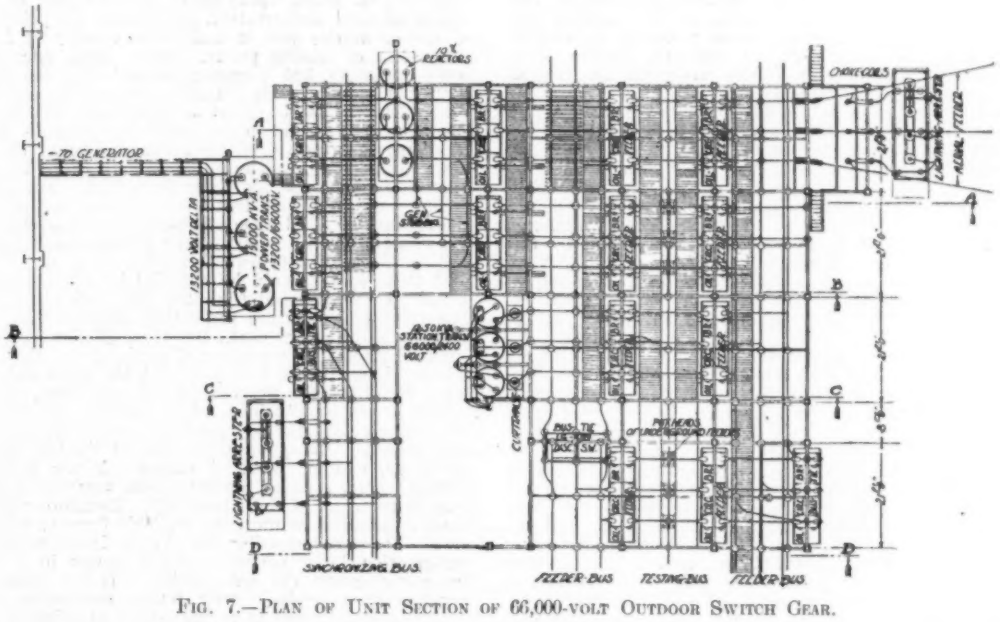



FIG. 7.—PLAN OF UNIT SECTION OF 66,000-VOLT OUTDOOR SWITCH GEAR.

switch yard, should make testing of cables and restoration of service most expeditious.

The outdoor structure has been planned with a view to greatest convenience of operation, low maintenance cost, and low first cost. It is proposed to use concrete poles with structural steel members connecting them at the top. This design results in a very rigid structure from which the wiring is supported at frequent intervals. The breaking of an insulator will not result in dropping a bus or a connection and such insulator can be replaced with the greatest facility. The few structural steel members will not require frequent painting. To provide for reaching the disconnecting switches easily

* From the *General Electric Review*, May, 1920. Abstract.

a plank walk raised slightly above the ground is proposed. This will make it possible to reach all of the disconnecting switches with a standard insulated switch hook, and it can easily be kept free from snow and ice in the winter.

Railway tracks are run through the various aisles to facilitate the removal of transformers and switches. In this connection it is to be noted that the switches are also to be provided with trucks similar to transformer trucks, so that a whole switch may easily be slid out from its position and taken to the repair shop in the station. To facilitate inspection of switches it is planned to have a truck equipped with an oil tank, a blower, and a pump, so that any switch requiring inspection may be quickly emptied and the oil fumes blown out of the tanks.

While this station was designed to meet certain specified conditions, it is felt that the design described is such as to be very generally applicable. This is important for local conditions, as any plant may change slightly from time to time, and the more flexible and generally adaptable the arrangement the better able it will be to meet any slight change in conditions. This same point also has the advantage, when combined with unit arrangement, as in this case, of making the design applicable to other changes in details, such as higher transmission voltage, and in general, for the conditions of almost any other location requiring such a large station.

## GAS *versus* ELECTRICITY.

On June 16th, Sir Dugald Clerk, K.B.E., &c., and Professors Arthur Smithells and J. W. Cobb were present at a meeting of the Institution of Electrical Engineers to reply to criticisms of the paper on "The Distribution of Heat, Light, and Motive Power by Gas and Electricity," read by Sir D. Clerk before the Royal Society of Arts, and "The Report on the Coal-gas and Electrical Supply Industries of the United Kingdom," made by Sir D. Clerk and his colleagues to the President of the Institution of Gas Engineers. Mr. Roger T. Smith (President, I.E.E.) opened the meeting by welcoming the visitors, and expressed his pleasure that it had been possible to arrange for an open discussion of the matter by experts. He referred to criticisms of the paper that had appeared in the technical Press, and asked Sir Dugald Clerk to read a short paper in commencement.

In the course of reading his "Note on the Thermal Efficiency of the Generation and use of Gas and Electricity," Sir Dugald stated that he wished to be quite fair to electricity, and that he had always mentioned in his papers on the subject that the electric motor possessed enormous advantages, and although the aggregate of gas engines in this country was over 1,000,000 h.p., a great many people preferred the electric motor. Indeed, in large gas-engine works the electric motor was used for a great many purposes. He welcomed the progress of electricity, and recalled the fact that the first application of a gas engine in Scotland to the driving of a dynamo for lighting purposes was one of his own engines in Lord Kelvin's room at Glasgow. He claimed an advantage for the gas engine in the matter of dealing with a uniform heavy load. The Report of the Coal Conservation Committee stated that by utilising electricity for power and heat a saving of 55,000,000 tons of coal per year could be effected. He (the speaker) did not know how the error was made, but apparently the committee had no idea of the present thermal efficiency of the modern gas works. The gas industry had been looked upon by certain people as a dying industry, but an industry with a capital of £200,000,000, and still growing, was certainly not that.

Mr. C. H. Wordingham was then called upon. For many years, he stated, he had been a consistent advocate that the two industries should join hands for the common good instead of considering themselves rivals, and had been equally criticised by both parties. He was now more than ever convinced that combination was the proper attitude to adopt. He thanked Sir Dugald Clerk for the lucid way in which he had made plain the meaning of his figures, leaving no doubt as to his claims, and inviting criticisms. He (Mr. Wordingham) felt that this challenge had to be accepted by electrical engineers, as failure to do so would be construed as an admission of their accuracy. There *were* facts, and the only way of ascertaining what those facts were was to approach matters in a scientific spirit. He did not propose to criticise the figures himself, as other speakers were prepared to do that, but would confine himself to general observations. Sir Dugald had properly pointed out that electricity was not a source of energy, but one might say that it was a gearing placed between the fuel and the consuming devices which had to utilise the fuel, and as a gearing it would have to be judged not merely by its efficiency, but by its convenience and utility. There was no doubt that because of this the average public liked "electrical gearing," and that was a good reason for its employment. Its very convenience meant that the heat economy was much higher than would appear from Sir Dugald's figures. Electric motors could be switched on or off as often as necessary, but this could not be done with a gas engine. When the latter was running light a great deal of heat, conserved from the coal, was being wasted. Admitting the accuracy of the figures, it appeared to the speaker that gas could be very much better applied as an additional link in the chain, and be utilised to drive electric generators rather than be supplied in its crude form to consumers. Thus the superior economy of the gas engine, if it *was* superior, would be combined with the advantages of electricity leading to increased efficiency.

Professor J. W. Cobb thanked the Institution for inviting him to take part in the discussion, which should be useful in encouraging a direct interchange of opinion on a vital subject. Proposals for the distribution of coal energy through electricity had been made recently. These were of a very drastic nature from the point of view of both industries, and were made in the name of coal conservation. They raised the question of what was the best method of liberating and distributing the energy of coal—or rather what were the agencies available, and what were their merits or demerits for a wide range of uses. The process of transforming heat units into power was very inefficient, in spite of the attention given to the subject by physicists and engineers. If the loss was not incurred at a central station it would be incurred elsewhere—in the latter case a heavier loss. For this reason, the electrical power station was increasing its hold on industry. When energy for purposes other than power was required circumstances were completely altered, and to take the power station for the supply of energy in general was to load up a process with the 80 or 90 per cent. initial waste of the station. An assertion of the position of the gas industry, in this respect, was necessary, and would be beneficial to all concerned. Technical developments in the gas industry had been delayed by the extent to which it was governed by statutory regulations, but legislative changes were now being made. The vague accusation, or supposition, of the inefficiency in the gas industry was never justified, even with regard to the older plant. The efficiency at gas works was so high and distribution losses so small compared with the corresponding figures for electricity, that a handsome margin of economy remained with gas even when the advantages of electricity at the point of use were taken into consideration. Although efficient in certain special cases, electricity was ill-adapted for heating purposes in general. The position as regarded fuel economy of the most modern power station was very unsatisfactory, and to lock up an enormous amount of capital in large stations and works of the same type would incur the danger of hindering progress. The speaker mentioned that 90 per cent. efficiency in the production of gas could be expected if cheaper oxygen were one of the results of certain investigations by Prof. McLellan into the production of helium. No one could foretell the developments in either industry, and the primary need of each was freedom to develop along its own special lines.

Mr. C. H. Merz, speaking as vice-chairman of the Committee on Coal Conservation, stated that the primary motive of the committee was to deal with economy of fuel in the production of motive power. Some small references were made to heating, but it could not be said that the report dealt with that question. Sir Dugald Clerk and his colleagues had referred to the whole report as if it dealt with heat energy. There was not a point in the report regarding the distribution of energy in a form available for motive power that he (Mr. Merz) would alter, and he would be surprised if his colleagues on the committee would differ from him. The speaker repudiated the suggestion that the committee had recommended the setting up of 16 large super-stations, it merely suggested the division of the country into suitable electrical districts and standardisation of periodicity, &c. It was never intended that these areas should be supplied by one station only—it would be uneconomical from the distribution point of view. The efficiency of future generating stations was repeatedly given as 17 or 18 per cent., but these efficiencies were being obtained already in a number of stations, and that with very inferior fuel. If the fuel possessed the same value as that taken for calculation purposes by the committee, much higher values would be obtained. The speaker agreed with Mr. Wordingham that the fuel point of view was by no means the only aspect. The question was one of the best employment of labour, and for practical purposes labour included coal. Motive power, even at present prices, represented only from 5 to 10 per cent. of the labour bill. Therefore motive power must be supplied in the most available form to reduce labour costs. It was impossible to expect improvement in coal conservation by distributing motive power in a form that the manufacturer did not require. It was clear that the question thus resolved itself into a comparison of saving labour in getting coal or saving labour in industry generally. The electric motor possessed the great advantage of being capable of operation by unskilled labour. It would maintain its efficiency if it ran at all. The gas engine would only maintain its 20 or 25 per cent. efficiency under very exceptional circumstances. Of recent factory installations a large percentage had employed electricity, and it was only the older factories, where the plant was in existence and the money had been spent, where other forms of motive power had been retained. The Coal Conservation Report did not suggest that the gas industry should disappear entirely. In Chicago, where electricity had been largely developed, the gas industry had not suffered. It was to the interest

of electrical engineers to encourage the gas industry. Electricity would make its way more and more as a distributing agent, and better systems of generation might possibly be obtained through the medium of gas, but they could not be obtained at present except in special cases. The speaker had figures of some of the largest gas stations in the world, which showed that their efficiencies were not appreciably higher than the efficiencies of the best electrical stations. The figures were based on actual metered units, not on horse-power-hours. Nevertheless, the two industries could be developed, and between them could do an enormous amount to improve the efficiency of labour, and to reduce the onerous part of it.

Mr. J. S. HIGHFIELD said that the two industries should certainly understand each other's point of view, and he stated that he was one of the few electrical engineers who had a joint contract for street lighting with a gas company. It was clear from the paper that if thermal efficiency was the deciding factor electricity would only be used for lighting, but the growth of the industry in a few years proved that thermal efficiency was not the main consideration. If efficiencies of 100 per cent. were assumed, and the prices of electricity, gas, and coal were taken as 1½d., 4s., and 40s. respectively, at the expense of 1d. electricity would evaporate 2.36 lb. of water from and at boiling point; with gas 12.9 lb. of water could be evaporated for 1d., and with coal from 60 to 70 lb., so that cost was not the determining factor, or no gas would be sold. The speaker noted with interest that in all his illustrations Sir Dugald contemplated the replacing of gas by electricity, and never the reverse process, and that gave him hope for the future. But it was out of the question to talk about substituting one for the other; the works would continue to exist and grow, to everybody's benefit. Each had its particular field—electricity for colliery motors, &c., and gas for cooking, for example. If the gas engineer could produce a better method of changing the heat energy of coal into power it would be all to the good. One of the gas engineer's handicaps had been the necessity for the construction of plant of the very largest size, as under modern conditions units of two or three thousand H.P. were not suitable.

Mr. C. P. SPARKS made reference to the figure of 55,000,000 tons given in the report (section 1, sub-section 9) as the annual saving in coal to be effected by the distribution of power on comprehensive modern lines. A footnote stated that no account was taken of possible saving on domestic coal consumption as a result of a comprehensive system of electric power distribution, and yet the speaker thought that Sir Dugald Clerk had mentioned that the figure included a large amount for heating. The estimated saving was based according to the paper on 1 lb. per electrical horse-power-hour, but the C.C.C.'s report gave this figure as 1¼ lb., and thus a 50 per cent. error had been made in the statement. There was also an error of 1,000,000 tons between two references. Electrical engineers were not wedded to any particular source of energy, and the speaker stated he would be glad if the gas engine could be used to cut thermal losses and something like 50 per cent. would be gained straight away. Gas was not available for detailed drive in factories, and the gas engine was not sufficiently flexible. In Pennsylvania, where natural gas was available, two of the largest and most prosperous electric power companies in the world were supplying motive power. With regard to the actual efficiency suggested on page 13 of the paper, it was stated that the ratio of thermal efficiency of gas to electricity was 13.4 to 10.4. Sir Dugald selected a gas engine, and said that it would run at 75 per cent. load all the time, but in small units this was not an operating condition. Even taking his own figures, the difference instead of being 30 per cent. in favour of gas, would only be 7 per cent., *i.e.*, a ratio of 13.6 to 12.8. Seven per cent. was a very small matter, and with modern improvements it was going to be wiped out. A direct comparison on a thermal basis was impossible. The figures given for lighting gave a small advantage to electricity, but an analysis of the figures and experience of lighting gave a greater advantage than stated. Employing Sir Dugald's own methods, Mr. Sparks calculated the comparative ratio of consumption as 1 to 2.15 in favour of electricity. Electricity, however, was not in direct competition against gas except for small services. The speaker concluded by hoping that the two industries would co-operate to a greater extent.

Mr. W. H. PATCHELL thought that far too much had been made of the so-called "attack on the gas industry," and Sir Dugald had drawn inferences from the report that were not actually in it. The committee had recommended the scrapping of existing plant when modern works became available, and 55 millions of the 80 million tons of coal per annum at present used in this country's industry, would be saved. The thermal efficiency of gas works was well known and improving, but the thermal efficiency of an electric station was also well known, and Sir Dugald Clerk knew that it was higher than the average figure taken. For purposes of comparison, Sir Dugald Clerk should have taken 18 or 18.5 and not 8.5 per cent. Mr. Patchell referred to the use of gas-driven electric power stations by gas works, and quoted the remarks of Mr. Fisher, a gas engineer, on the popularity of electricity for lighting and small motors. The speaker asserted that the competition of electricity had been the making of the gas industry, but there was still plenty of room for both.

Colonel R. E. B. CROMPTON spoke of the relative efficiencies of gas and electricity for ordinary heating purposes, and came to the conclusion that for purely local heating electricity was at an advantage. Col. Crompton then dealt with the cooking problem, and deplored the waste of gas by servants. He gave an amusing account of a thermal storage gas-heating apparatus constructed by Mr. Druitt-Halpin and himself, that was so efficient, and took so little gas to heat about 16 gallons of water a day, that it did not turn the meter.

Sir DUGALD CLERK, in reply, defended his attitude of alarm at the Coal Conservation Committee's Report by quoting various parts of the report suggesting the substitution of electricity for gas. The only reason that the substitution of electricity for gas was assumed in the paper was for purposes of calculating the equivalent service to be given. He stated that he would make a full reply in writing later.

Professor SMITHELLS expressed his thanks for the opportunity of discussion given by the Institution, and hoped that friendly relations would continue to exist between the two industries.

A hearty vote of thanks was accorded to Sir Dugald Clerk and his colleagues for the pleasure given by their presence.

## THE NATIONAL PHYSICAL LABORATORY.

### ANNUAL INSPECTION.

THE annual visit to the National Physical Laboratory, Teddington, by the general board took place on June 22nd, when Sir Joseph J. Thomson, president of the Royal Society and chairman of the board, Sir Arthur Schuster, vice-chairman, and other members of the board welcomed a large gathering at the laboratory.

The present director of the laboratory is Sir Joseph E. Petavel, K.B.E., D.Sc., F.R.S., who succeeded Sir Richard Glazebrook last September. The laboratory is now organised in seven departments—physics, engineering, aeronautics, metallurgy, electricity, metrology (measurements of length, area, volume, mass, and time), and the William Froude national tank for tests of ship models; the physics department includes divisions for heat and thermometry, optics, radium and X-ray work, and tide-prediction.

During the past year new buildings have been erected, and additions to the existing buildings will shortly be erected, notably an extension of the engineering department. The Admiralty also proposes in future to make fuller use of the facilities afforded by the laboratory, and is erecting a building for special Admiralty work immediately adjoining it. Investigations of more general character will be carried out for the Admiralty by the laboratory.

The normal work of the laboratory was displaced during the war period by special work required for war purposes. A return has now been made by the laboratory to the discharge of its pre-war functions; there is much leeway to be made up, and the large amount of routine work that is undertaken to some extent hampers original research, but it is understood that the matter is receiving attention, and it is hoped to solve the present difficulty.

The apparatus and experiments shown in the different departments included many items of interest, and one wished for more time in which to make a more extended inspection of the various features of interest.

In the engineering department apparatus for carrying out tests on the fire-proofness of magnetos was on view, as well as an interesting new fatigue testing machine for reversals of direct stress by means of an alternating magnetic flux. The reversals per minute reach 2,000, and the range of load of the machine shown was plus or minus 0.75 tons. The machine was constructed by Messrs. Brunton's, Ltd., to the design of Dr. B. Haigh.

In the electrotechnics building of the electricity department experiments on moulded insulators to determine the electrical strength and mechanical stiffness at different temperatures, as well as standard A.C. measuring apparatus, and the calibration of a voltmeter up to 100,000 volts, were seen. Measurements of the illumination given by coal-miners' lamps, experiments on ship's navigation lamps with regard to the design of lenses and the colour of side lamps, standard lamps so designed that the filaments are all in one plane, together with the measurement in candles per unit area of luminosity of radium-painted dials were demonstrated.

Manganin made in the laboratory with curves of temperature coefficient of resistance were exhibited in the direct-current division. Also a selenium cell current regulator was seen in operation. This device operates by means of a spot of light falling on to one of two selenium cells, the latter being made to increase or decrease the current as the case may be. The instrument worked in conjunction with a new generator which has recently been installed for testing purposes. It has an output of 5,000 amperes at 12 volts, and consists of two generators and a motor to drive them, all three machines being coupled together on one bedplate. A separate exciter is installed.

At Bushy House an Abraham block multi-vibrator for the absolute measurement of wireless frequencies, and the Board of Trade standard instruments and apparatus for absolute electrical measurements, were on view. The measurement of constancy of frequency of oscillating values by the Campbell inductance-capacity bridge, and the measurement of the effective inductance of 4-terminal resistance standards was also demonstrated.

In the wireless hut in the meadow, methods of determining the characteristics of valves, and of measuring the efficiency of a transmitting valve and the amplifying power of valves at audible frequency were shown. Visitors were also able to hear the reception of wireless telephony and telegraphy from the Marconi station at Chelmsford and from Burlington House, London.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Current Density in Wires at High Temperatures.

Can you, or any of your readers, tell me why it is not considered to be in accordance with orthodox theory to assert that the physical stability of a wire, heated by means of electricity, is affected by current density as well as temperature?

Can it be that the effect of current density has hitherto been regarded as negligible owing to non-appreciation of the enormously high value to which current density may attain in small wires at very high temperature?

Let us take, for example, the question of current density in incandescent lamp filaments, and we find that it is of an unexpectedly high value. I say unexpectedly advisedly, because I have asked men who should know the true value to guess what it is in the case of an ordinary 200-volt, 40-watt tungsten filament lamp, and have never been able to obtain a higher guess than 16,000 amperes to the square inch, whereas the actual value is about 250,000 amperes to the square inch.

In heating apparatus, current densities up to and exceeding 40,000 amperes to the square inch are in accordance with everyday practice.

I suggest that the effect of such high current densities on the "life" of hot wires should be made the subject of exhaustive discussion and research, and that it is really contrary to orthodox theory (as to the conditions produced during the passage of electricity through a conductor) to maintain that the value of the current density is a quite unimportant factor that can be safely disregarded.

It may well be the controlling factor as regards the different results attainable with wires of small and large diameter, respectively, in which latter, under otherwise equal conditions, the current density is relatively low.

**C. Orme Bastian.**

London, W.
*June 24th*, 1920.

### Power Development in U.S.A.

Your issue of June 18th contains some statements which hardly do you justice as the leading organ of the electrical trades, for your "recent" improvements, on page 779, and "a novel scheme" on page 770, really, to use a vulgarism, have whiskers on them.

It may interest you to know that the pawl starting device described as a recent magneto improvement was used on the old Mark I tank in 1916, and had been in existence for some time previous to this even. A more positive and better idea was used in the later improvements in tanks.

May I point out also that the principle involved in the "novel scheme" embodied in the American power station design has been in use at the Formby power station of the Lancashire & Yorkshire Railway Co. for the past ten years. But we went one better: we used the total condensate and feed water as circulating water for the auxiliary condenser, and have a system of auxiliary feed heating really without an air pump, yet work on a 15 in. to 20 in. vacuum.

We originally installed the complicated surge tank method described in your article on page 797, but scrapped it for something simpler.

Referring back to page 770, you say that "it was claimed that the kilowatt-hour could be generated with a consumption of less than 1.5 lb. of good coal with generators of 60,000 to 75,000 KW.," and your following remarks convey the impression that this comes as a startling fact. If it is not generally known, I may tell you in all seriousness that we in England hope to generate the kilowatt-hour on 1 lb. of good coal with turbines one-sixth of the American sizes.

The "house" turbine idea and high pressure economisers will not, I venture to state, become standard on this side of the pond. We have something better.

Perhaps our American friends will let us know if the man who opens the ash hopper doors wears a gas mask, or translated into American "Sammy" language, a "breath box," or perhaps the remainder of the article will describe the system of remote control with biased relays necessary to prevent this man from becoming asphyxiated.

**A. E. Carr,**
*Superintendent Engineer,*
*L. & Y. R. Power Station.*

Formby.
*June 21st*, 1920.

[With regard to the magneto improvements, the remarks to which Mr. Carr refers were not ours, but were given, as stated, on the authority of Messrs. A. P. Young and H. Warren in the *Proceedings* of the Institution of Automobile Engineers; if we cannot trust the experts, to whom shall we turn for guidance? Many improvements that were made during the war were kept secret, and are only now attaining publicity, so that they justly rank as novelties to the outer world. As regards practice at the Formby power station, little publicity has been given to its operations, and we cannot be expected to know as much about it as the superintendent engineer; when we visited the plant at its opening in 1904, it was by no means in advance of current practice elsewhere.

With regard to the proposed generation of a kilowatt-hour with one lb. of coal, we congratulate Mr. Carr on this (prospective) success; we, also, "hope" to see it done. In the meantime Mr. I. V. Robinson in his paper on "Power Station Design in Relation to Thermal Efficiency" at the I.M.E.A. Convention states the following conclusion: "That a maximum consumption of 20,000 B.TH.U. per unit generated be the objective in large stations." His paper represented the views of some ten British turbine-makers; and the *objective* to be aimed at is given as 20,000 B.TH.U., which is practically 1.5 lb. of good coal (13,500 B.TH.U. per lb.). It is well known that the size of turbine, above 10,000 or 15,000 KW., makes little difference in the economy. But Mr. Carr seriously hopes that Mr. Robinson's present ideal will be beaten by one-third in this country—it is a bold forecast. We sincerely hope that it will be justified by the event.—EDS. ELEC. REV.]

### Direct Current Compared with Three-Phase Current for Driving Steel Works Plant.

Under the above heading an extract from a paper read before the Iron and Steel Institute was published in the June 11th issue of your journal. The author, whilst treating the subject in a very interesting manner, appeared to have a bias in favour of D.C. driving, which led him to include in his general depreciation of A.C. driving many cases where that method can fully justify its use.

It cannot be granted, at the outset, that owing to the relatively small areas covered by iron and steel works, the question of the greater ease of transmission of A.C. power is of no great importance. The growing popularity of A.C. power, the large number of central stations which supply it, its advantages from the point of view of generation, transmission and distribution, and the saving in the cost of installing rotary converting plant, are alone sufficient to make the steel works engineer fully explore the possibilities of A.C. driving before rejecting it for D.C., and these possibilities are in certain instances such as fully to warrant its adoption. In many cases, particularly when used in conjunction with up-to-date auxiliaries, the A.C. drive is undoubtedly to be preferred, even apart from the considerations touched on above.

In making comparisons of the types of drives to be adopted for rolling mills, each case must be treated on its merits, since in no other class of drive must more varying conditions be met. The writer of the paper referred to above makes a comparison in the case of a merchant mill between a D.C. motor rated at 1,200 H.P., full load speed 150 R.P.M., and an induction motor of the same rating and synchronous speed. The speed of each motor is supposed to be reduced so as to drive the mill at 115 R.P.M. The speed reduction is effected in the case of the induction motor by inserting resistance in the rotor circuit, and the author points to the large speed variation and inefficiency of the induction motor under these conditions.

Does this necessarily condemn the A.C. drive? Surely it only emphasises the fact that an unsuitable method has been used to obtain the desired speed reduction. There is on the market a perfectly reliable and simple equipment by the use of which the main motor speed can be reduced to the required value at no load, the speed drop on load being only some 8 to 10 per cent., such as is necessary to obtain stored energy from a flywheel. Moreover, this speed reduction can be obtained with a loss of only 2½ per cent. to 3 per cent. in overall efficiency. The use of this equipment has the further advantage that the power factor of the main motor can be improved to unity on full load, and maintained at a high value on overloads and light loads. The overload capacity of the main motor is thus maintained, and does not fall off as in the case where a permanent resistance is used in the rotor circuit. This eliminates the argument that a smaller capacity motor can be installed if a D.C. drive is adopted.

The speed variation obtainable by using this equipment depends on the frequency of the supply. On a 25-cycle supply

a speed variation of 75 per cent., and on a 50-cycle supply a variation of 46 per cent. can be obtained. The equipment referred to is small and comparatively inexpensive. Assuming the works obtains its supply from an outside source, that supply will be A.C. in nearly every case owing to the lower cost of transmission. If power is generated in the works it will again—if turbines are installed—probably be A.C. In both these instances the cost of an A.C. drive with auxiliary speed regulating apparatus will be lower than that of a D.C. motor and rotary converter.

Where extreme speed variations are required, as in the example given of a 400-H.P. motor operating between 60 and 250 R.P.M., the D.C. drive is, of course, to be recommended, but even so, a motor of large and expensive design would be required to give the desired speed range. This is, furthermore, a particular case, and not one on which to base a comparison. One would be ill-advised to adopt an A.C. drive in this case, just as in the present stage of development one would not use an A.C. drive for a reversing mill. Other extreme cases entirely in favour of the A.C. drive are as easily found. Such is a continuous wire mill, where the A.C. drive is to be preferred from the point of view of simplicity of design and first cost.

If the nature of the rolling operation is such as to necessitate close speed regulation, then the A.C. drive is the more suitable, since the speed variation of the induction motor with no external resistance added to the rotor circuit is less than that of a D.C. motor of similar speed and power. It should be noted here that close speed regulation is not considered safe practice in the case of D.C. motors, which have to deal with varying and suddenly applied loads. To obtain it the motor must be either of very large capacity, or else be differentially compounded, with attendant dangers in the case of excessive overloads.

It is again quite good practice to use the induction motor drive for that class of mill where the load is of the nature of sudden peaks lasting for, say, a few seconds, such as the case illustrated in fig. 1 of the article referred to, and where speed variation is not required other than to utilise flywheel energy, and so smooth out peaks in the demand on the supply system. Here external resistance in the rotor circuit is used, but this resistance must be only that necessary to reduce the peak to a predetermined value. This can be done satisfactorily by means of a slip regulator of the contactor type. This type of regulator is automatic and extremely rapid in its action, the magnetically operated contactors opening or closing, and thereby altering the amount of resistance in the rotor circuit in the fraction of a second.

The author of the article dismisses this class of regulation with the remark that it is too slow in action to be of value, but he doubtless has the sluggish and jerky liquid slip regulator in mind, and it is only necessary to see the contactor type at work to appreciate its rapid action. The regulator is usually designed to combine the duties of starter and slip regulator, and the contactors can be set to operate at any desired current to limit the demand from the supply to some predetermined value both whilst starting and regulating.

Greater efficiency is obtained because the resistance in circuit at the beginning of a pass is small. In the event of loads occurring of small amount or short duration, a small amount of resistance will be inserted in the rotor circuit. After the load is removed the motor will attain its maximum speed more rapidly if used with the slip regulator than if used with a permanent resistance, because as the motor speeds up the contactors close and maintain the torque at a high value.

Many general statements in the article, other than those referred to above, can be shown to be correct only in particular instances; but perhaps enough has been said to show that the question whether D.C. or A.C. is the better system for rolling mills depends on the circumstances of the case. It may at least be said that a bias towards the D.C. system is unwise, and this will be endorsed by experienced steel works engineers, and also by experts in the employ of those manufacturing concerns which, making all types of electrical machinery, have in consequence no predilection for any.

**R. S. Jones.**

Rugby.
*June 21st*, 1920.

---

### Non-union Labour and Supply Undertakings.

I do not know whether the electric supply industry fully appreciates the seriousness of the proposal made in Mr. Webb's letter dated June 14th which was published in your issue of the 18th. In this letter it appears that the members of the electrical trades and other unions in the employ of electricity undertakings may refuse to connect up work done by non-union labour in the Greater London area. This proposal may fairly be reckoned to be a challenge from the Electrical Trades Union to the employers. The issue is not between the electrical undertakings and their own employés, but between the unions and another branch of the industry altogether. In other words, the unions calmly propose to use the undertakings to enforce their claims in matters in which the undertakers themselves have not the remotest interest or control. There is here a most important principle at stake. If the unions are allowed to use the electric supply undertakings in one quarrel, they would in another, and no one can say where it will stop. Certainly the matter is a very serious one, and deserves the earnest consideration of the industry. There should certainly be a clear-cut policy.

**Electric Supply.**

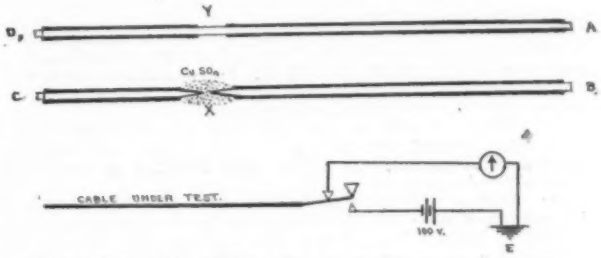
*June 25th*, 1920.

---

### Cable Fault Localisation.

In the REVIEW dated June 4th, there was published a most instructive article by Mr. Edward Raymond-Barker, referring to a recent cable fault problem submitted by the writer, under the pseudonym "Kon Denser." The fault as found by the writer suggested a very interesting problem, and the actual localisation was not so simple as it appeared to be. Two single V.I.R. 7/14 S.W.G. cables, each 100 yd. long, were laid in single glazed-ware troughing, filled in with pitch, and covered with red tiles. At 8 *p.m.* on April 23rd, discontinuity occurred on one of these cables, and the following afternoon the writer was requested by a friend to "have a go" at the localisation of the break.

On arriving at 3 p.m., the writer, testing with the "Megger," found continuity on both the cables; the insulation resistance between each cable and E was 60,000 ohms, and between the cables also 60,000 ohms. Putting 100 volts across one end of the cables, and a carbon filament lamp across the other ends, only a very dull glow was noticed. Then replacing the carbon lamp with a metallic filament lamp, a much brighter glow was obtained. Shorting the terminals of the lamp, whilst it was burning, did not blow a 5-amp.




TWO SINGLE 7/14 V.I.R. CABLES IN GLAZED TROUGHING, FILLED IN WITH PITCH.

fuse. This was sufficient proof that the fault was of a high resistance.

The difference in temperature between 8 p.m. the previous day and 3 p.m. the following day was sufficient to expand the copper strands of the cable to test out to continuity, and this was rather a rude shock to my friend, who always tested out a discontinuity the previous evening. There being no earthed sheathing, as surmised by Mr. Raymond-Barker, and as shown in the sketch accompanying his article, I decided to resort to the inductive capacity test. On the spot was a stand-by house battery of 100 volts, so I was able to get any testing voltage from 2 to 100. In my mind I diagnosed the fault to be as shown in the accompanying sketch, one cable being broken and bared at X, and the other one bared at Y, giving me the constant test reading of 60,000 ohms. I found that I got the best results by using the full voltage obtainable, namely, 100 v., and a d'Arsonval galvo, along with a highly insulated tapping key. I did not trouble about the actual capacities in terms of microfarads, simply jotting down the actual discharge throws in terms of scale divisions. The first attempts were very misleading, there being inconsistency in repeated discharge throws until the fault, regarding its constitution as a condenser, settled down. The sketch submitted by Mr. Raymond-Barker would not have been of any use in this instance. Keeping the testing voltage, test lead, galvo, and earth leads constant, I obtained consistent inductive capacity discharge throws from point A, then D, then B, then C, then from A, with D and C coupled, and then from C with A and B coupled. Working upon these calculations I made out the fault to be 20 ft. from C. Upon digging up, and chipping out the pitch, the fault was found to be exactly as shown in the sketch. The pitch had not been properly heated, it had the appearance of having been laid in flakes; water had found its way into the cable, and a small pocket of copper sulphate enclosed the fault at X, a most beautiful high resistance job. By 6 p.m. the same evening the plant was running on load again, the fault having been repaired. I was rather of the same opinion that Mr. Raymond-Barker holds, that a single cell giving a low testing voltage would give the best results in this type of test, but I found that this did not pan out in actual testing. The method suggested in the latter part of Mr. Barker's article would work out quite well, giving a much quicker result. Earthing the sound cable would be similar to earthing the sheathing wires of an armoured cable, the condenser effect being set up between the broken ends of the faulty cables, through the pitch, rubber covering of the sound cable, and the earthed core of the sound cable. This would constitute a somewhat similar condition to that used by the writer in his tests, the difference being that the capacity of the fault would be greater than in the writer's test, owing to the

sound core being dead earthed, against its being 60,000 ohms. The more one looks at the simple sketch, the more numerous do the different condenser effects become apparent. Each of the seven strands of the broken cable, at either side of the break, was eaten away to the very finest needle point.

I wish to thank Mr. Raymond-Barker for his great kindness and the interest he took in my problem, although I had found and localised this fault a week before the editors so kindly published his article in the Review. The conclusion I came to was that in order to localise a fault of this description, all apparatus, voltage, leads, earth connections, must be kept constant when testing from different points.

**T. D. Spark, A.M.I.E.E.**

Whitehaven.

## LEGAL.

### Marconi's Wireless Telegraph Co. *v.* Hamilton.

This case was mentioned to Mr. Justice Astbury in the Chancery Division on Friday, June 25th.

Mr. Hogg, K.C., said he had a motion on behalf of the plaintiffs to continue an injunction that was granted *ex parte* in the previous week by Mr. Justice P. O. Lawrence to restrain the defendant from publishing certain documents contrary to the terms of an agreement in writing entered into by him. An affidavit had been filed by the defendant, who now appeared in person.

Mr. Justice Astbury: I am interested in a company that used to be connected with the Marconi Co., but it is no longer connected with it, as far as I know. I do not know whether anyone objects to my hearing the motion. His Lordship asked the defendant whether he objected.

Mr. Hamilton said he had not had an opportunity of instructing counsel, but he had a written statement which he wished to submit, and which dealt with the matter his Lordship had raised.

Mr. Justice Astbury was handed the statement, which he read and gave to Mr. Hogg, saying it might amuse as well as interest him. There were statements in the letter which were wholly untrue as far as his Lordship was concerned, but in the circumstances the parties had better get another judge to hear the motion.

Mr. Hogg read the letter, and said he appreciated what his Lordship said; it did both amuse and interest.

His Lordship: There is a suggestion of guilt, and things of that kind, but it is absolutely false. There was a time when I had an interest in the American Marconi Co., but I understand that has now ceased. I do not know much about it. His Lordship asked the defendant if there was any other judge in the Division that he happened to have an objection to.

Mr. Hamilton said he had no objection to his Lordship hearing the motion. He wished to cast no reflection on his Lordship. The information in the letter was conveyed to him, and he thought he ought to show it to the judge.

His Lordship: After reading that letter, I shall decline to hear the motion. His Lordship said he would ask Mr. Justice P. O. Lawrence to hear the motion, and left the court to speak to that judge. On his return, he said Mr. Justice Lawrence would be pleased to hear the application "nominally" for him.

Later in the day Mr. Hogg renewed his application before Mr. Justice Lawrence. He read an affidavit in support of it, which stated the facts relating to the action which Mr. Hamilton brought against the company in 1913, when he recovered a sum of money. Later on he started fresh proceedings, and as the company were anxious to get on with their business, in May last they made the agreement with Mr. Hamilton which was the subject of the present application. This agreement recited the facts that he had referred to, and there was the payment of a sum of money, and a release of all claims by the company or Mr. Isaacs against Mr. Hamilton, and a release by Mr. Hamilton. The latter was to discontinue the Isaacs action, and not to bring any more actions, and there was to be a withdrawal of all charges. Paragraph 6 stated that Mr. Hamilton would not in any way molest Mr. Isaacs nor interfere with or do anything prejudicial to the business of the company, and it was provided that Mr. Hamilton was not to be prevented from entering other service. At the same time Mr. Hamilton covenanted that he would not at any time directly or indirectly produce to any person any of the documents or correspondence connected with the action. The money, said counsel, was paid on May 3rd, and on the same day Mr. Hamilton wrote to the company asking them to employ him. They refused, and a correspondence followed in which Mr. Hamilton spoke of the necessity of putting his position right, and said he did not see how he could re-establish his reputation without making a public explanation of the whole matter, including the terms of the agreement of May 3rd. He said in another letter that he proposed to submit all the particulars to every member of the Marconi Co.

Mr. Hamilton told his Lordship that he had not broken the terms of the agreement, nor threatened to act in violation of its terms, nor did he desire to act in that way. He said he contended that under that agreement he had not undertaken not to disclose the documents, and he believed that he was entitled to do that so long as he did not go beyond the stipulations in the agreement.

His Lordship: You are not to publish any of the documents relating to the case. Will you give an undertaking until the trial of the action?

Mr. Hamilton said there was a meeting of the shareholders of the company on Tuesday, when he wished to make explanations of the matter to the other shareholders. If he was debarred from doing that he could do nothing for twelve months. He asked to be allowed to read an affidavit he had prepared.

Mr. Hogg said from what he had seen of it, this affidavit referred to the very matters which were the subject of the *ex parte* injunction.

Mr. Hamilton: The application for the injunction was made in open court, and I wish to read my affidavit in open court. I have been charged with dishonourable conduct. No man can stand under that, and I trust do all I can to vindicate myself.

His Lordship: You are not allowed to do that which you deliberately agreed not to do.

Mr. Hamilton: I am a shareholder in the company, and as such I consider that the agreement was made with me and the other shareholders. I submit, therefore, that I am entitled to make explanations to the shareholders at the meeting on Tuesday.

His Lordship: I am afraid you will find yourself in prison if you disclose to anybody any of the documents concerned in this matter, whether they are shareholders in the company or not.

Mr. Hamilton: But I contend that no court in the world can debar me from clearing my character.

His Lordship: I am not going to try the case on this motion. I am going to keep matters in *statu quo* for everybody.

Mr. Hamilton: Am I to understand that I am not to go to the meeting on Tuesday?

His Lordship: If you do go you are not to go counter to the agreement.

Mr. Hamilton: Shall I be unable to tell the shareholders —

His Lordship: You would be well advised not to tell them anything. He asked if he would be willing to give an undertaking if there was a speedy trial of the action.

Mr. Hamilton said he would do so if he had an early opportunity of clearing his character.

His Lordship thereupon said that upon this undertaking he would order a speedy trial of the action, and gave liberty to either side to advance the hearing when the case was ready.

### Osram-Robertson Lamp Works, Ltd., *v.* The Public Trustee and Another.

In the Chancery Division, on Tuesday, Sir Arthur Colefax, K.C., applied to Mr. Justice Russell to take this case on Friday. He said the question to be dealt with related to patents which were German-owned at the outbreak of war, and the Public Trustee's position was that the plaintiffs had got to make out their case. One of the difficulties of the case was that an important witness had to go abroad at the end of the week.

His Lordship said it would be in the list for Friday morning (to-day).

### Walkington *v.* Howard Electrical Co.

At the Notts Assizes, Arthur Walkington, an electrical engineering traveller, of West Bridgford, was awarded £57 and costs against the Howard Electrical Co., of Nottingham, for wrongful dismissal. Plaintiff's case was that he was engaged in February last year as a traveller at £3 a week and commission, and he duly carried on until September, when he was dismissed without notice. He claimed three months' notice. The defence was that he left of his own accord, and that he had drawn in advance of his commissions account by £63, but this was disputed. Judgment was entered, as stated, for two months' salary with agreed commission.—*Sheffield Telegraph.*

### Electricians as Court Assessors.

In the City of London Court, on Monday, before Assistant Judge Jackson, Mr. Arthur Dunkley, trading as the City Electrical Plant Co., 31, Barbican, claimed £83 against Semco, Ltd., 19 and 20, High Street, Shoreditch, for electrical work done. There was a counter-claim for £64. Defendants said that the work was done so negligently and improperly that it was of less value to them than the amount claimed by £64. They also said they had suffered damage by the plaintiff's breach of contract to repair several motors, a ship's oscillating fan, a ¼-h.p. fan motor, &c. They alleged that the armature and brush rocker tests were weak, the fields showed a dead earth, and workmanship was bad, and the wires used were faulty. The bearings had to be rewound and rebushed, the armature was so unskilfully repaired that it struck the pole pieces, and the motor ran badly for a short time. Scrap metal and lead wire were used instead of white metal lining,

and the bearings had to be relined. An amended counter-claim was filed increasing the amount to £133.

Mr. WALTER STEWART, plaintiff's counsel, said there was no justification whatever for the defendants' counter-claim. There would be many electrical details to go into, and he wondered if the learned judge was familiar with such matters.

The ASSISTANT JUDGE said he was quite ignorant of electrical affairs.

Mr. STEWART said he found some difficulties, although he had had some practical experience. The counter-claim involved the consideration of an immense amount of detail.

The ASSISTANT JUDGE felt that the case ought to go before a man who thoroughly understood electrical business.

Mr. STEWART did not see how a judge, unassisted by an electrical engineer as an assessor, could deal with the case.

Mr. SAMUEL DUNCAN, defendants' counsel, was not in favour of the principle of substituting experts for judges. There was bound to be a certain amount of technical evidence.

The ASSISTANT JUDGE was sure of that.

Mr. STEWART suggested that if there was any point on which the judge needed the services of an assessor, the parties would be quite willing that he should speak privately to some independent electrician.

The ASSISTANT JUDGE was sure it would be more satisfactory to refer the case to an electrical engineer.

Mr. STEWART remarked that the counter-claim had been filed without regard to the well-known authority of Hadley *v.* Baxendale as to the remoteness of damage. He could not trust an electrical engineer to arrive at an accurate conclusion as to the remoteness of damage.

The ASSISTANT JUDGE offered to reserve all those questions. He would apply to the president of the Institution of Electrical Engineers to nominate someone.

Mr. STEWART was anxious to minimise expense. It would be disastrous if the case ran on for days, as the assessor's fees might then come to more than the claim.

The ASSISTANT JUDGE did not think a very eminent man was necessary. One wanted a thoroughly practical man who understood his business. He thought he could hit on someone who would not charge a heavy fee.

Mr. STEWART suggested that they could reduce the scope of the reference.

The ASSISTANT JUDGE did not think that would help. It would only lengthen the case.

Mr. DUNCAN: Short cuts generally involve the longest way round.

The ASSISTANT JUDGE concurred, and said the case would be referred to an electrical engineer to be nominated by the Court.

## REVIEWS.

*Coal Mining and the Coal Miner.* By H. F. BULMAN. Pp. 338, 19 illustrations. London: Methuen & Co., Ltd. Price 15s. net.

This is really a delightful book; and coming at a time when most men's minds are more or less perturbed about the coal question, and the rights and wrongs of the miners' claims, it is refreshing to read something devoid of exaggeration and prejudice.

The author has a life-long experience of his subject, and throughout the book there runs a deep sympathetic feeling for the miner and his work. As he tells us in the preface: "Having been a colliery manager and a director of colliery companies, and having lived for many years amongst the working miners, the writer knows and appreciates their work and their sterling qualities. Certainly they deserve to be well paid, well housed, and not overworked." On the other hand, "the book was written before the Coal Commission commenced its novel proceedings—and it may perhaps serve as a useful corrective to some erroneous ideas which have arisen from the proceedings of the Coal Commission." Had the book been written for this special object it could not have served its purpose better.

The book is divided into some twenty chapters, dealing with labour in mines, wages, disputes, accidents, science and electricity in mining, the value and extent of our coal resources, legislation, distillation, and the economical use of coal, investment of capital, rescue work, and last, but not least, miners' houses are very fully dealt with. It may be remembered that at the Coal Commission Mr. Smillie said a lot about miners' houses, and on this point Mr. Bulman says in his preface: "The miners' representatives on the Coal Commission did their best to create prejudice very unfairly against colliery owners, by blaming them for the bad housing of miners. The truth is that colliery owners, most of whom, it should be remembered, are small shareholders, have done more than most employers to provide houses for those they employ. It was given in evidence before the Coal Commission that during the ten years 1904-14, there was spent in purchasing or in building, or in improving miners' houses in Durham and Northumberland, £2,567,000." In Chapter XX the question of houses is very fully dealt with, and illustrated with plans and photographs, which might be of considerable interest to some of the miners' leaders, as well as to the ordinary man in the street, who hears so much on one side but so very little on the other.

Then with ergard to wages, we learn that the effect of the Minimum Wage Act has been to raise miners' wages by an amount variously estimated at £1,000,000 to £2,000,000 a year. Coal hewers in County Durham were earning eight shillings a shift of seven hours in the year 1913, or working full time of eleven days a fortnight, a hewer could earn £4 8s., or £2 4s. per week. "Working full time, his hours of work are 77 hours in the *fortnight*. Thus his working hours amount to 23 per cent. of the total hours in a fortnight, and for 77 per cent. of his time he is free to do as he likes." In 1918 wages had risen to over £4 per week for the highest-paid class as a *minimum*, and have continued to rise ever since with the price of coal. On the other side, dealing with capital, the author shows that the yield in profit to the shareholder is about the least in any industry, and puts it at about 5 per cent. "The estimated cost of producing 192,000,000 tons of coal during the year ending July 16th, 1920, which has been supplied by the Government to the House of Commons, allows for labour £210,250,000, and for owners' profits £12,500,000, out of a total cost under all heads of £281,250,000. According to these figures labour gets 74.7 per cent. of the total cost, and capital only 4.4 per cent." We might go on making interesting extracts from other parts of the work, especially those dealing with "the miner and his work," and "trade unionism"; but not only would this be unfair to the author, we should in addition fail to give to the reader the impression of truth and sincerity of the information given in its pages, the value of which cannot be estimated to those who are anxious to get at the real facts of this most interesting question. It is a book which we hope will be widely read and discussed.

---

*The Principles Underlying Radio Communication.* Radio Pamphlet No. 40 of the U.S. Army, Signal Corps. Washington: Government Printing Office. Price 55 cents.

This is a very complete and taking little volume prepared by the Bureau of Standards, under the direction of the chief signal officer of the U.S. Army, training section. It therefore has an official standing, and it would be unfortunate if it were otherwise than a praiseworthy production. With a few exceptions the information contained is sound and reliable. It is certainly worth much more than the 55 cents for which copies can be obtained from the Government Printing Office at Washington, D.C. As stated in the preface, the book presents briefly the basic facts and principles of electromagnetism and their application to radio communication. It is intended to suit students who have had very little mathematical training. Some 355 pages with 238 illustrations are comprised, and the book is thoroughly well got up.

After a careful perusal of the book the reviewer is of opinion that some improvement could be effected in the method of treating the principles of electrostatics. The subject is of considerable importance in radio work, but it is dismissed in a comparatively brief section. For some reason magnetics are almost invariably dealt with in a much fuller way in books of instruction, magnetic lines of force and magnetic flux being quite adequately treated. There is no obvious reason why electric lines of strain and electric flux should not be just as fully explained. Some of the statements made show that the author or authors are imbued with many of the prevalent fallacies; thus, the upper regions of the atmosphere are definitely "fairly good conductors" owing to ionisation, while "clouds and other meteorological conditions" would cause great variation in the sharpness of the conducting boundary. As in most American text books the electronic theory of currents is accepted as an indisputable fact. An explanation of the mechanism of radiation from an antenna on the moving lines of strain view is attempted, but is rather laboured and unconvincing. It is suggested by the reviewer that the method of explanation, though it may apply with some degree of accuracy to effects taking place beyond a quarter wave length radius from the oscillator or antenna, does not apply in its simple form within that distance. The explanation of the mechanism of reception given is similarly unsatisfying. The cutting of an antenna by a magnetic field does not convey an adequate idea of the draining of energy from the parts of the dielectric medium within its reach. In section 159 buzzer transmission for short ranges is referred to, but it is very doubtful whether the scheme of buzzer transmission shown could be made to operate over any useful distances. The method shown depends on the charging of a minute condenser to a few volts. In practice it is very much better to shunt the buzzer coils and rely on breaking a considerable current which is caused to pass through the inductance coil of the oscillatory circuit. The considerable magnetic energy then liberated starts the effective oscillations and radiations. Exception could also be taken to several of the statements and explanations referring to continuous wave apparatus. Whilst considerable improvement is possible in the character of the information contained, yet on the whole the book is a very creditable and valuable production.—J.E.T.

## NEW PATENTS APPLIED FOR, 1920.

**(NOT YET PUBLISHED.)**

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,016. "Electrical accommodation denoting cabinet." P. A. Tillinghast. June 14th.

16,034. "Arrangements for coupling two alternating-current electric systems in parallel." Ateliers de Constructions Electriques du Nord et de l'Est. June 14th. (France, January 22nd, 1914.)

16,048. "Connection boxes for electric conductors." J. M. L. Slater and R. Wightman. June 14th.

16,049. "Intercommunication telephones." Edison Swan Electric Co. and J. C. Wrighton. June 14th.

16,050. "Switch devices for telephone apparatus." Edison Swan Electric Co. and J. C. Wrighton. June 14th.

16,051. "Telephone apparatus." Edison Swan Electric Co. and J. C. Wrighton. June 14th.

16,054. "Coil ignition apparatus for internal-combustion engines." D. A. V. Rist. June 14th.

16,064. "Production of high unidirectional voltages from an alternating voltage. Siemens-Schuckertwerke. June 14th. (Germany, May 15th, 1918.)

16,066. "Reduction of inductive effect of telegraphic currents." Siemens & Halske Akt. Ges. June 14th. (Germany, September 27th, 1918.)

16,070. "Telephone systems." Western Electric Co. June 14th. (United States, June 14th, 1919.)

16,094. "Vacuum tube apparatus, and method of controlling same." Marconi's Wireless Telegraph Co. June 14th. (United States, June 14th, 1919.)

16,095. "Radio transmitters." Marconi's Wireless Telegraph Co. June 14th. (United States, June 14th, 1919.)

16,106. "Suspension of electric traction wires." Metallurgique Electrique. June 14th. (France, February 19th, 1914.)

16,128. "Electrical switches." F. A. Griffin. June 15th.

16,148. "Electrical energy-distributing systems." J. W. Goodman. June 15th.

16,154. "High-frequency electrical signalling systems." Western Electric Co. June 15th.

16,164. "Vapour electric apparatus." Westinghouse Cooper Hewitt Co. June 15th. (Switzerland, June 20th, 1919.)

16,170. "Electric distribution systems." British Thomson-Houston Co. (General Electric Co.). June 15th.

16,177. "Transmitting and receiving circuits for wireless telegraphy and telephony." A. K. Macrorie and G. Shearing. June 15th.

16,183. "Apparatus for directed wireless telegraphy and telephony." E. Bellini. June 15th. (France, November 4th, 1916.)

16,186. "Obtaining increased light electrical effect in light electrical cells, &c." A. Sinding-Larsen. June 15th.

16,232. "Electrical fuses." H. E. Sutherland. June 16th.

16,235. "Sparking plugs." G. B. Sykes. June 16th.

16,257. "Electrically-heated bed warmers, heaters, &c." N. Hosgood. June 16th.

16,261. "Electrically-operated fuses for explosives." E. E. V. Breil. June 16th.

16,266. "Signalling systems." Western Electric Co. June 16th. (United States, August 31st, 1915.)

16,274. "Telephone systems." Automatic Telephone Manufacturing Co., P. T. Bates and R. Mercer. June 16th.

16,294. "Apparatus for heating water by electricity." Luftfahrzeubau Schutte-Lanz. June 16th.

16,310. "Suppression of sparking at interruption of conductors traversed by current." Siemens-Schuckertwerke. June 16th. (Germany, July 29th, 1915.)

16,311. "Sparkless disconnection of conductors traversed by electric currents." Siemens-Schuckertwerke. June 16th. (Germany, October 9th, 1915.)

16,312. "Distribution devices for motor engines." J. A. C. Bois and E. V. Reno. June 16th. (France, January 29th, 1914.)

16,314. "Electric-heating elements." Akt. Ges. Kummler & Matter. June 16th. (Switzerland, June 16th, 1919.)

16,328. "Slip-rings for induction motors." T. Seisakusho. June 16th.

16,369. "Bow current-collectors in overhead wire systems of electric traction." Brecknell, Munro & Rogers and A. M. Willis. June 17th.

16,389. "Electro-metallurgical process for manufacture of ductile bodies of high-fusing metals, &c." E. Aoyagi. June 17th.

16,399. "Interrupter switch." R. Alkan. June 17th. (France, August 19th, 1919.)

16,403. "Telephone transmitters." M. Miessner Inventions Corporation. June 17th. (United States, June 23rd, 1919.)

16,404. "Electrical signalling systems." L. de Forest. June 17th. (United States, March 13th.)

16,407. "Electric lamp-holders." F. A. P. Payne. June 17th.

16,415. "Generation of electrical oscillations." British Thomson-Houston Co. June 17th. (United States, July 8th, 1919.)

16,430. "Vacuum-intensifier with glow cathode and auxiliary electrode." Siemens & Halske Akt. Ges. June 17th. (Germany, May 31st, 1916.)

16,431. "Starting of electric arcs." Siemens & Halske Akt. Ges. June 17th. (Germany, July 21st, 1919.)

16,432. "Arc lamps for searchlights, &c." Siemens-Schuckertwerke. June 17th. (Germany, August 20th, 1917.)

16,433. "Vacuum rectifiers with rotating electric arc." Siemens-Schuckertwerke. June 17th. (Germany, October 23rd, 1915.)

16,457. "Brush-gear for dynamo-electric machines." J. Stone & Co. June 17th. (United States, February 16th, 1917.)

16,468. "Automatic electrical magnetic cut-in and cut-out mechanisms." G. A. G. Knott and W. Oates. June 18th.

16,485. "Controllers for multiple electric circuits." E. and N. R. Booth. June 18th.

16,499. "Electro-mechanical change-speed gear." P. E. H. Malerme and R. E. Raynaud. June 18th. (France, June 20th, 1919.)

16,501. "Alternating-current systems." Siemens-Schuckertwerke. June 18th. (Germany, December 20th, 1915.)

16,514. "Telephone instruments." S. A. Lazarus. June 18th.

16,521. "Magnetic separators." F. Krupp Akt. Ges. Grusonwerk. June 18th. (Germany, July 11th, 1919.)

16,525. "Magnetic separators." F. Krupp Akt. Ges. Grusonwerk. June 18th. (Germany, August 2nd, 1918.)

16,547. "Current leading-out device in magneto-electric ignition apparatus for single-cylinder internal-combustion engines." Scintilla. June 18th. Switzerland, June 21st, 1919.)

16,550. "Sparking plugs." C. Zorzi. June 18th. (Italy, August 28th, 1918.)

16,572. "Charging-apparatus for storage batteries." Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). June 18th.

16,573. "Spark plug." Plunkett Energising Spark Plug Corporation. June 18th. (United States, August 31st, 1918.)

16,576. "Electrodes." J. K. Forshee. June 18th. (United States, March 18th.)

16,585. "Interrupting powerful electric currents." A. M. Taylor. June 18th.

16,594. "Device for cleaning sparking plugs." J. H. Wood. June 19th.

16,606. "Production of electrical oscillations by thermionic valves." N. Lea and Radio Communication Co. June 19th.

16,618. "Push-button switches." V. T. Ohrstrom. June 19th.

16,630. "Balancing-device for commutators of electric machines." Siemens-Schuckertwerke. June 19th. (Germany, June 27th, 1914.)

16,631. "Dynamo-electric machines." Siemens-Schuckertwerke. June 19th. (Germany, November 10th, 1914.)

16,632. "Electric driving of ship propellers." Siemens-Schuckertwerke. June 19th. (Germany, August 1st, 1916.)

16,633. "Self-starting induction motors." Siemens-Schuckertwerke. June 19th. (Germany, January 29th, 1918.)

16,636. "Electric cables." L. R. Lee. June 19th.

16,642. "Employment of telephone receivers in electric transmission receiving circuits comprising thermionic valves." Soc. Francaise Radio-Electrique. June 19th.

16,644. "Magnetic work holders." H. Graf-Buchler and O. Coradi. June 19th. (Switzerland, June 19th, 1919.)

## PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

### 1917.

14,796. "Directive wireless telegraphy." E. R. Clarke. October 12th, 1917. (Complete specification accepted, February 4th, 1920. Patent sealed, February 4th, 1920.) (143,580.)

### 1918.

12,656. "Electrical transmision, particularly applicable to radio-telegraphy and telephony." L. Levy. August 4th, 1917. (143,583.)

21,278. "Systems for driving hoists, rolling mills, and electric locomotives." Vickers, Ltd., C. F. Mackness and H. H. Broughton. December 19th, 1918. (143,588.)

### 1919.

3,280. "Electrode and fastener for electro-medical appliances." E. E. Greville and F. W. Read. February 11th, 1919. (143,593.)

4,220. "Electrical plug-and-socket switches." J. A. Crabtree. February 20th, 1919. (143,599.)

4,291. "Multi-speed dynamo-electric machines." F. Creedy. February 20th, 1919. (143,600.)

4,586. "Ignition magnetos." E. C. R. Marks (Splitdorf Electrical Co.). February 24th, 1919. (143,614.)

4,622. "Electrodes for electrolytic recovery of metals from solutions." H. Wade (Central Mining and Investment Corporation). February 24th, 1919. (143,619.)

4,623. "Electrolytic recovery of metals from their solutions." H. Wade (Central Mining and Investment Corporation). February 24th, 1919. (143,620.)

4,719. "Winding-machines for electrical coils and the like." H. Wade (Universal Winding Co.). February 25th, 1919. (143,624.)

4,751. "Electric selective signalling." Western Electric Co. (Western Electric Co.). February 26th, 1919. (143,625.)

4,832. "Electric discharge devices." British Thomson-Houston Co. (General Electric Co.). February 26th, 1919. (143,630.)

4,940. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co.). February 27th, 1919. (143,636.)

7,636. "Processes and apparatus for sherardising." S. O. Cowper-Coles. March 26th, 1919. (143,674.)

7,763. "Electric lamps." J. H. Hall. March 28th, 1919. (143,676.)

7,764. "Winding machine for covering straight lengths of wire or rods." I. B. Blaiberg. March 28th, 1919. (143,677.)

8,873. "Electrode holder for use in electric cutting and welding." E. C. R. Marks (Electric Arc Cutting & Welding Co.). April 8th, 1919. (143,685.)

10,219. "Sparking plugs." H. Singleton-Griesbach. April 24th, 1919. (143,693.)

10,268. "Galvanic batteries." G. & J. Oldham. April 24th, 1919. (Cognate application 11,206/19.) (143,695.)

11,978. "Electric liquid-heaters." G. P. Watson, J. K. Greenhill, H. B. C. Pollard. May 13th, 1919. (143,704.)

13,510. "Electron valves." Connecticut Telephone & Electric Co. August 8th, 1918. (130,965.)

13,812. "Electrical generators or dynamos." R. T. Norton. May 31st, 1919. (143,720.)

15,439. "Control for electric furnaces and the like." British Thomson-Houston Co. (General Electric Co.). June 19th, 1919. (143,737.)

17,388. "Self-regulating dynamos." W. R. Smith. July 11th, 1919. (Addition to 131,978.) (143,750.)

19,353. "Electric-plug connectors and lamp-holders." W. Ile. August 6th, 1919. (143,759.)

23,270. "Electrically-driven talking-machines." J. S. Bradshaw. September 22nd, 1919. (143,779.)

23,637. "Means for detecting unauthorised use of incandescent electric lamps." A. Pohle. August 28th, 1918. (133,051.)

27,397. "Electric switches." British Thomson-Houston Co. and H. Trechman. November 6th, 1919. (143,795.)

28,265. "Appliances for regulating the hardness of Röntgen-ray tubes." H. F. Eiken. November 14th, 1919. (143,797.)

32,346. "Electrical circuit controllers." F. Bechoff. December 24th, 1919. (143,806.)

32,693. "Electrical toy motors." M. V. O'Leary. December 30th, 1918. (Divided application on 141,105.) (143,807.)

**Rain Making.**—Mr. Balsillie's report of his rain-making experiments at Hopetoun (Vic.), and his frank admission that he was unable to make rain, have raised doubts whether it is worth the Federal Government's while to continue the expenditure of money in experimenting any further. According to the Sydney *Daily Telegraph*, the Minister for Defence has stated that the operation of a rainfall stimulation station in a district had apparently, in every instance, coincided with a more than average amount of rainfall in the district for the period of working. Increased rainfall was of such vital importance to Australia generally, that it had been decided to continue for a time the operation of the two existing stations. The Melbourne *Age* cites expert opinion to the effect that no useful result has been attained.